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BLACK WATER – GREY SETTLEMENTS

October 2014

KU LEUVEN

ARENBERG DOCTORAL SCHOOL
FACULTY OF ENGINEERING SCIENCE

BLACK WATER – GREY SETTLEMENTS

Domestic Wastewater Management and the Socio-ecological Dynamics of Jakarta's Kampungs

Prathiwi Widyatmi Putri

Dissertation presented in partial fulfilment of the requirements for the degree of PhD in Engineering Science

October 2014

Supervisor:
Prof. dr. Frank Moulaert

Co-supervisor:
Ir. Teti Armiati Argo, M.E.S., Ph. D.

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Dana Pendidikan


Planning
&
Ontwikkeling
Development

The cover image photographs were taken by the author in Kampung Kojan, 2011

To humanity

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Writing in English is quite a challenge for me who received education in Bahasa Indonesia up to the

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Prathiwi, Leuven September 2014

SAMENVATTING

Zwart Water – Grijze Nederzettingen

Huishoudelijk Afvalwaterbeheer en de Socio-ecologische Dynamiek van Jakarta's Kampungs

Dit PhD onderzoek behandelt de problemen van afvalwaterbeheer in relatie tot de gefragmenteerde ruimtelijke ontwikkelingspraktijken in de informele steden van het Mondiale Zuiden. Vier theoretische families – stedelijke politieke ecologie, institutionalisme, literatuur over informaliteit, en sociale innovatie – zijn met elkaar in dialoog gebracht om een omvattend analytisch raamwerk te ontwikkelen. Dergelijk raamwerk is in staat onderzoek mogelijk te maken van ongelijke toegang tot water- en afvalwaterinfrastructuur in verschillende wijken en gemeenschappen, de reproductie van sociaal-ruimtelijke ongelijkheden in Jakarta, en tevens de falende besluitvorming in stedelijke gemeenschappen. Behalve een raamwerk voor een kritisch begrip van hedendaagse ontwikkelingsprocessen ten aanzien van milieu en sanitaire voorzieningen in relatie tot ongelijke economische ontwikkelingen is het analytische gereedschap tevens van nut als een leidraad om toekomstige ontwikkelingsstrategieën te analyseren.

Naast theoretische-methodologische bespiegelingen, draagt dit onderzoek ook bij tot empirisch begrip van Jakarta en haar wijken: hoe sanitaire voorzieningen en de water sector in het algemeen, en afvalwaterbeheer in het bijzonder, functioneren. Vanwege een ruimtelijke fragmentatie in de gebouwde omgeving, en een verscheidenheid aan sociaaleconomische en fragiele geo-ecologische condities in verschillende stadsdelen en de stad in haar geheel, wordt geargumenteerd dat Jakarta een gedecentraliseerde aanpak met betrekking tot afvalwaterbeheer dient aan te nemen. Dit onderzoek adresseert de notie van een gedecentraliseerd afvalwaterbeheer zo dat multi-scalaire ontwikkelingsbenaderingen met betrekking tot sanitaire problemen van de onderling verbonden huishoudens en de stad in haar geheel onderzocht kunnen worden. Dit onderzoek beoogt tevens het vinden van potentiële beleidsplatforms voor het gedeeld aanbieden van water en sanitaire voorzieningen die een actieve rol van gemeenschappen in ontwikkeling mogelijk maken. Het onderzoek geeft in het bijzonder aandacht aan informaliteit met betrekking

tot water en sanitaire voorzieningen en de manieren waarop het in relatie staat tot ‘reguliere’ initiatieven van de staat en de markt. Dit onderzoek concludeert dat informaliteit, met een verscheidenheid aan vormen van wederzijdse dynamieken als fundering, niet slechts een overleveringsstrategie is maar ook een bron voor creativiteit in het aanbrengen van verbindingen tussen ecologische kansen, technologieën – zowel traditioneel als ook hedendaags – en modi van zelfregulatie in relatie tot anderen.

Dit PhD onderzoek heeft tot doel het huidige begrip van de sociaalecologische dynamiek van stedelijke kampungs in Jakarta te verbeteren, waarin ongelijkheden in basis sanitaire voorzieningen en dienstverlening voortbestaan. Het benadrukt een aantal sleutelvraagstukken van ruimtelijke ontwikkelingen die aangepakt moeten worden om een geschikt antwoord te kunnen formuleren op de heterogene sociaalecologische problemen in Jakarta, en met name in haar kampungs. De thesis is gebaseerd op de premisse dat de ruimtelijke kwaliteiten in de stedelijke kampungs verbeterd kunnen worden door een geïntegreerde benadering van waterbeheer – door het combineren van terreinen en schalen van interventie alsmede dimensies van ontwikkeling. Als voorstander van de integratie van waterbeheer en ruimtelijke planning, en binnen het raamwerk van strategische planning, benadrukt deze PhD thesis het belang van sociaal innovatieve co-productie waarin interactieve stedelijke projecten voor succesvolle lokale ontwikkelingsinitiatieven woden geïncorporeerd.

SUMMARY

Black Water – Grey Settlements

Domestic Wastewater Management and the Socio-ecological Dynamics of Jakarta's Kampungs

This PhD research addresses the problems of wastewater management in relation to the fragmented spatial development practices within the informal cities of the Global South. Four theoretical bodies – Urban Political Ecology, Institutionalism, literature on Informality, and Social Innovation – have been put into dialogue with each other in order to develop a comprehensive analytical framework. Such framework is capable of examining the discrepancy in access to water and wastewater infrastructure by different neighbourhoods and communities, the reproduction of socio-spatial inequalities in Jakarta, as well as failing governance in urban communities. Besides providing a framework for a critical understanding of the contemporary environmental sanitation infrastructure development processes in relation to uneven economic development, the analytical tool also helps to develop an approach for analysing future development strategies.

In addition to its theoretical-methodological reflections, the research also contributes to the empirical understanding of Jakarta and its neighbourhoods: how the sanitation and water sector in general, and wastewater management in particular functions. Due to spatial fragmentation within the built environment, diverse socio-economic and fragile geo-ecological conditions in different settlements and the city as a whole, it is argued that Jakarta should adopt a decentralized approach to wastewater management. The research addresses the notion of decentralized wastewater management in a manner of searching multi-scalar development approaches to the interconnected household and city-wide sanitation problems, as well as of finding possible governance platforms for water and sanitation service co-provision that allows for an active role of communities in development. It gives a particular attention to informality in water and sanitation service provision and how it interacts with 'regular' state and market initiatives. The study finds that informality, with varying forms of reciprocal dynamics as its foundation, is not only a survival strategy but also a source of creativity in connecting ecological

opportunities, technologies – both traditional and contemporary – and modes of self-regulation to each other.

This PhD research seeks to improve current understanding of the socio-ecological dynamics of Jakarta's urban kampungs, in which disparities in basic sanitation infrastructure services persist. It highlights some of the key spatial development issues that must be addressed in order to formulate an appropriate response to the heterogeneous socio-ecological problems in Jakarta, especially in the kampungs. The thesis is built on a premise that spatial qualities in urban kampungs can be improved through an integrated water management approach – combining fields and scales of intervention as well as dimensions of development. In favour of integrating water management and spatial planning, and within the framework of strategic planning, the PhD thesis argues for the importance of socially innovative co-production that incorporates interactive urban design projects for successful local development initiatives.

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LIST OF ABBREVIATIONS - ACRONYMS

BAPEDA	Badan Perencanaan Daerah (Regional Development Planning Agency)
BAPPENAS	Badan Pembangunan Nasional (National Development Planning Agency)
BPLHD	Badan Pengendalian Lingkungan Hidup Daerah (Regional Environmental Management Agency)
BPS	Badan Pusat Statistik (Central Statistic Agency)
DKI Jakarta	Daerah Khusus Ibukota Jakarta (Special Capital District of Jakarta)
FAKTA	Forum Warga Kota Jakarta (Jakarta Residents' Forum)
GPOBA	Global Partnership on Output Based Aid
GBC	Green Building Council
IAD	Integrated Area Development
JICA	Japan International Cooperation Agency
KIP	Kampung Improvement Program
KRuHa	Koalisi Rakyat untuk Hak atas Air (People's Coalition for the Rights to Water)
MPL	Masyarakat Peduli Lingkungan (a resident group for environmental protection)
OWOF	Our Worlds Our Family
PAM Jaya	Perusahaan Air Minum Jakarta (Jakarta water supply company)
PDPAL Jaya	Perusahaan Daerah Pengolahan Air Limbah Jakarta (Jakarta wastewater company)
PPKT	Program Perbaikan Kampung Terpadu (integrated kampung improvement programme)
PPSP	Program Percepatan Sanitasi Permukiman (the national acceleration programme for urban sanitation development)
PUSH	Program of Urban Sanitation and Hygiene Promotion
RT	Rukun Tetangga (the lowest level of neighbourhood unit)
RW	Rukun Warga (neighbourhood unit containing several of RT, see above)
Samijaga	Sarana Air Minum dan Jamban Keluarga (Drinking Water and Latrines for Households)

SSK	Strategi Sanitasi Kota (City Sanitation Strategy)
STP	Sludge Treatment Plant
UPL/UKL	Upaya Pemantauan Lingkungan/ Upaya Kelola Lingkungan (action plans for environmental monitoring and/or management)
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant
YLKI	Yayasan Lembaga Konsumen Indonesia (Indonesian Consumers' Association)

Juriah and her social circle in Kampung Kojan

I do not know how old Juriah is. She did not know either, when we asked. But her appearance and life history suggest that she is probably in her late 50s. Young Juriah came to Kampung Kojan to join her husband, whose family had been living in the kampung. After her first husband died, she met her second husband in the factory where they both worked.

At the time of this fieldwork, Juriah was a single parent, a mother of four. The youngest –a teenager– was still dependent upon her. She ran a small kiosk selling everyday groceries, including bottled water; she occasionally sold clothes door-to-door and also owned some rental rooms, which perhaps provided the family's biggest source of income.

She had eight rental rooms in a two-storey building, covering a total floor area of around 80m2; four on the ground floor (two pairs of back-to-back rooms) and another four on the upper floor. Two steep staircases faced each other, leading to the upper rooms. Sometimes her tenants paid the rent and/or electricity bills late. For her, this was tolerable.

Juriah benefitted from the Mercy Corps programme and received assistance to construct septic tanks. She acquired two units, one for her latrine and another one for use by her tenants, who live around fifty metres away from her house. She said, without this help from the NGO, she would still be using the canal for faecal waste and grey wastewater disposal. She told us, "It [the septic tank] is useful, because it is [almost] free".

Marzuki is Juriah's eldest son. When we met, he lived with his wife and son a few meters away from his mother. He worked for the air police department, probably as a lower-level officer. We talked with him for around an hour, in front of Juriah's kiosk, about the history of Kampung Kojan and daily life in the kampung.

He said that, until around 10 years ago, people often found fish (ikan talas) in the canals to cook. He continued talking about piped water in the kampung, which ran intermittently and at low volumes. To ease the water problem, some households had installed pumps to boost supplies, but this made it more difficult for others to get water. He also told us that the developer of the adjacent housing estate had bought the old factory site in order to build new high-rise apartments.

With his wife and three children, Arif had been living in a 9m^2 room owned by Juriah for six years. He had worked in a factory before his current job as an automotive salesman. His wife had a temporary contract as a shift-work with a factory in the vicinity of Kalideres sub-district, like most of their tenant neighbours. When both parents were at work, the children were cared for by their grandmother, who lived nearby. They paid 17 USD per month for the room, five USD for electricity, and three USD for portable gas. The electricity bill was calculated according to the electrical appliances used by each tenant. Together with other households living in Juriah's building, they shared two bathrooms, each with a toilet. There was also a shared well, water from which could be boiled for drinking.

Take from the field research notes made by Prathiwi and Setiaji – 16, 22 and 24 September 2011

< (above)
The room with open door was where Arif and his family lived. Setiaji, the research assistant, is sitting in the doorway

Source: the author, 2011

< (below)
The two bathrooms used by Juriah's tenants, one for male and another for female users.

Source: the author, 2011

A.

WATER IN THE CITY:
A RESEARCH AGENDA

1. INTRODUCTION

Water has always been an essential element in the production of cities. It adds a vital dimension to the social (re)production of space (see Gandy, 1999, 2004; Swyngedouw, 1999, 2004). Flowing across territorial boundaries, the fluid object has challenged the binary oppositions of urban and rural as well as the dichotomy of nature and culture (Gandy, 2004; Swyngedouw, 2006).

Water flows and their material, symbolic, political and discursive construction have been used as an entry point to examine the process of modern urbanization (Swyngedouw, 1999). While access to water and sanitation has been acknowledged as universal human rights, the collective construct of modern water consumption patterns has various meanings to various population groups. Households in different neighbourhoods within diverse socio-ecological contexts adopt different water use strategies. It is my interest in this research to examine how the diversity of practices and forms of institutionalization in the water and sanitation sector perform dynamic interplays with the formation of contemporary urban settlements. I find that this is a rich topic through which scholars can formulate a multi-scalar approach to spatial development planning.

The number of (mega)cities in low- and middle-income countries has increased and many of them are located at the seaside (UN-DESA, 2012). Being exposed to the sea and located in areas with high precipitation while facing deteriorating urban environments and pressing population problems, sustainable water management is of critical importance in Jakarta and other coastal cities in the region. Yet, sustainable water management necessitates sustainable water governance, and it is increasingly difficult to ignore that active communities are at the heart of such a governance system (Douglass, 1992; Hardoy et al., 2005).

This PhD research is an engagement with the problems of access to water and sanitation in urban areas, especially for domestic use within poor neighbourhoods. The research affirms close correlations between discrepancies in water and sanitation services with increasingly fragmented water governance and the deepening uneven development (see also Allen et al., 2006; Bakker et al., 2008; Hardoy et al., 2005). I recognize that the right to water is inseparable from the right to the city (see Harvey, 2008), in the sense that is far

beyond the goal of securing individual access to water. The paths towards desired forms of urban environment cannot be divorced from the journeys of seeking better social ties, human-nature relationships, and urban cultures (Ibid., 2008). The ultimate vision is that through collective efforts in securing community access to water, social relations and urban governance can be improved to overcome poverty and socio-environmental vulnerability.

This chapter provides a general introduction to the subject of my PhD research. The next section presents the trajectory of my research. Sections three and four consecutively introduce two subjects on marginalization: i) wastewater management as the least advanced development sector; and ii) urban kampungs as the most neglected yet socially-rich urban spatial enclaves. Section five explains the methodological approach, the theoretical underpinnings, and the methods of data gathering used in this research.

2. A PERSONAL RESEARCH TRAJECTORY

My involvement with the post-2004-Tsunami reconstruction programme in Aceh has become an important point of departure for my intellectual journey. During my 18-month stay in the province, I was amazed by the fact that affected communities were able to quickly rebuild their settlements, even if in rudimentary form, after such a shocking abrupt loss of their homes and with a history long-lasting military conflict. Relying on kinships and friendships, new clusters of temporary shelters were constructed between two to three months. Our longer-term interventions, however, soon revealed that sufficient water and sanitation services, as well as drainage infrastructures were well beyond the capabilities of households and communities. This working experience provided an important insight about the unavoidable interplays between housing, water and sanitation sectors within local development interventions. Specifically, it became clear to me that a comprehensive intervention could only be addressed through a multi-scalar development approach.

Together with my personal experience of growing up in one of Jakarta's southern kampungs, from where I witnessed first-hand the growth of the 'modern' city, the Aceh experience has very much shaped this PhD research. However, there are more recent personal engagements with the sanitation development sector that have helped the formulation of the research. **Table 1** provides information about the personal timeline with events that preceded and crossed the journey of this PhD research, from which milestones of the research focus were developed. In the table, the links between these milestones and sections of this general introduction, as well as the main chapters of this dissertation, are presented.

Table 1. A personal timeline and the PhD research

No.	*Period*	*Personal events*	*Influences on the PhD research*	*The outputs of the PhD research correlated with the personal events*
1.	February-September 2008	Research for master thesis in the Master Program of Human Settlements, KU Leuven.	Title: *Reclaiming Waterways for Urban Regeneration. Testing an Urban Design Model of Water Management Strategy on Cikapundung River Basin, Bandung, Indonesia*. The findings suggest that wastewater management could play an important role for structuring urban development and kampung improvement programmes.	I questioned to what extent this issue has been recognized by local government agencies. In that I studied past as well as more recent sanitation development programmes and their approaches to kampungs. The result is presented in this general introduction (Section 3 and 4) as well as Paper 2 and 3.
2.	November 2008-February 2009	The development of PhD research proposal for the VLIR-UOS scholarship competition	*The initial focus of the research was on the different household consumption patterns of water and sanitation services in two Indonesian coastal cities: Jakarta and Surabaya.* *The proposal was intended to research the interplays between the 1) morphological patterns of coastal city, 2) the spatial distribution of urban kampungs and 3) the governmental dynamics, all of which play important roles in shaping the consumption patterns of water and sanitation services.*	
3.	March-May 2009	The European Module in Spatial Development Planning – Newcastle University	The module has given me an important insight for the mobilization of (neo-Marxist) critical theories. It was an important trajectory that altered my earlier understanding of political economy that can be seen mechanistic for being too much focusing on the conflicts within the formal industrialization processes. I overlooked the informality dynamics that are highly embedded in Indonesian cities.	Throughout the years of PhD research, in parallel to the empirical research, I have worked on an analytical framework to study the water and sanitation sector in cities of the global South. The final frame is presented in Paper 1.
4.	July-August 2009	Assisting in a research project at the Ministry of Public Housing on some past housing upgrading projects in five Indonesian cities, including Jakarta.	Through this working experience, I have come to an understanding about some limitations within the state-driven formal housing development processes and gained insights about the importance of the co-existence between the housing self-provision in kampungs and the formal housing provision system.	The continuation of the research was concentrated on Jakarta with spatial emphasis on its urban kampungs. Addressing diverse socio-ecological conditions in kampungs, I conducted a historical research on the transformation of kampung spatial distribution. The study is mainly presented in Paper 2.
5.	August 2009	Assisting in a research project on *The Political Economy of Sanitation* for the World Bank/ Water and Sanitation Program with Oxford Policy Management	During this period, I had a chance to explore the administrative and policy making dynamics within the Indonesian sanitation sector. It was an important period to understand some of the key national sanitation development programmes in the last three decades.	▪ Identifying governmental agencies involved in the key national sanitation development programmes. ▪ Tracing sanitation development initiatives that were specifically made for Jakarta, both by the national and provincial governments. The result is partially presented in this general introduction (Section 3.2.) and mainly in Paper 3.
6.	October 2009	Official start of the PhD research		
7.	July 2010 – October 2013	Having a work-contract as water and sanitation consultant for a Corporate Social Responsibility programme of a multinational mining company in West Papua	Within this period, I visited Kabupaten Bintuni three times both for working in some remote villages around Bintuni Bay as well as for working closely with the Health Agency and some civil society organizations in the administrative capital. Each of the field visits was an important moment to temporarily detach from urban sanitation problems. It exposed me to the institutional dynamics related to rural sanitation in West Papua.	I fully realized that both in urban and rural contexts, the government at all tiers has limited capacities and capabilities to address community environmental sanitation needs. During this period I explored sanitation development initiatives from actors beyond the state. Paper 3 and 4 are the main outputs that reflect my views on development.

Source: the author

This PhD research is centred on wastewater management in Jakarta, with a special territorial focus on urban kampungs. I further limit the main focus of the research to domestic wastewater management. By 'domestic', I mean non-industrial activities that produce wastewater, usually from the lavatory and kitchen. In the discussions within the main chapters, I often treat wastewater management as part of the sanitation sector, and in many occasions, as a critical component of environmental sanitation. This I do in order to stress the scope of waste water management beyond the issues of personal hygiene. In many works, 'sanitation' is often reduced to 'private and safe place to urinate and defecate' (Napitupulu & Hutton, 2008; WHO/ UNICEF, 2010). In Indonesia, the sanitation sector includes wastewater management, clean water supply, solid waste management, and neighbourhood drainage. In this research, I consider wastewater management also as an integral part of the urban water sector, which also consists of clean water provision, as well as storm water and flood management (see Silveira, 2001). Especially in the discussions within the first main chapter, the term 'water and water sanitation' is used to stress the link between clean water provision and wastewater management. These two elements are vital for the closure of the local water loop, which I consider vital in achieving a community hydrological balance. My reflections on the problems of wastewater management within the context of Jakarta's waterscape, as well as the Indonesian sanitation sector (see **Figure 1**) are described more fully in section three of this chapter.

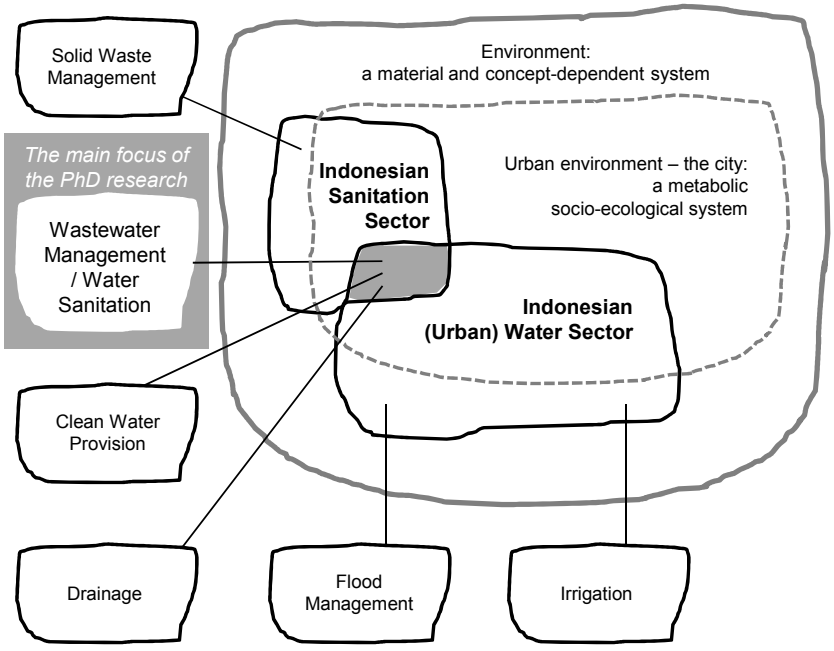

Figure 1.
The main focus of the research and its context
Source: the author

Throughout this research, I pay a great attention to diverse institutionalization modes of water and sanitation services with which different socio-territorial processes are transforming continuously. I particularly observe that at the neighbourhood level, water and sanitation needs are not only met by the 'formal' services offered by the state and the market. Kampung neighbourhoods provide many different types of service for the inhabitants as well as for the upper class communities in neighbouring areas. Despite their contributions in sustaining the socio-ecological metabolism of the city however, residents of kampungs have not been actively involved in the state-led planning processes. I further problematize the presence of kampungs and their communities within the context of Jakarta's historical spatial transformations in section four of this general introduction.

The outputs of the PhD research are four papers that are presented in this dissertation as the main chapters. They were initially developed in parallel in the beginning of the research in order to delineate non-overlapping research focus. These are stand-alone papers yet thematically, theoretically and empirically interconnected. In each paper, the specific research aims are explained.

3. JAKARTA: A CITY DROWNING IN BLACK WATER

For millions of people in Jakarta and the Metropolitan Region, January might not be the best period of the year. Annual flooding recurs in that month, as heavy rains continuously pour throughout the region. For the locals, *Januari* means *hujan sehari-hari* or 'it rains every day'. In 2014, floods hit the capital city on 8 January. They could yet prove to be as severe as the ones that inundated almost 20 per cent of the city for at least eight days in the previous year[1]. Jakartans find it also difficult to forget the heavy flooding of 2002 and 2007 (Texier, 2008). When roads in the city dry up again, life seems to go on as normal, but some calamities caused by flooding remain. When I began writing this introductory chapter in January 2014, the flooding had caused 11 deaths while 64,000 people had sought refuge and 22,000 sought treatment at Jakarta's health centres because of flood-related illnesses.[2]

Within the overall water infrastructure sector, combating flooding has actually been one of the top priorities for the government of DKI Jakarta (*Daerah Khusus Ibukota Jakarta*/ Jakarta Special Capital Region). Tackling flooding has been a popular political agenda because it has been seen as a visible and tangible environmental issue affecting every layer of society. Nevertheless, many experts have criticized the government's approach towards flooding. It has been argued for example, that the government has been too confident with the

application of modern infrastructures like canals and dikes to reduce flooding by discharging excess water as quickly as possible into the sea, even after it has become obvious that these technologies alone would never free Jakarta from inundation (Gunawan, 2010).

Regular inundation and sedimentation are natural and normal phenomena because the city sits on flat low-lying land situated in a delta area of 13 rivers carrying heavy silt from the uplands (Caljouw et al., 2005; Putri & Sari, 2010). Urban development processes have been continuously ignoring the geo-ecological conditions of the area, promoting but not sufficiently regulating private property development. Both real estate developments and fast-growing informal settlements are scattered across the metropolitan region in a manner that inhibits perform proper environmental management (Douglass, 2010; Steinberg, 2007). The anthropogenic impacts on the city's hydrological and geo-morphological systems cause calamities like floods and water-borne diseases that have for centuries shaped the socio-ecological landscape of Jakarta (Caljouw et al., 2005; Kop, 2008; Texier, 2008).

Aware that flood canals alone cannot keep Jakarta dry, policy makers began to consider the approach of giving more space to water in the city. The current Joko Widodo administrative government of DKI Jakarta has prioritized engineering works for revitalizing the existing water

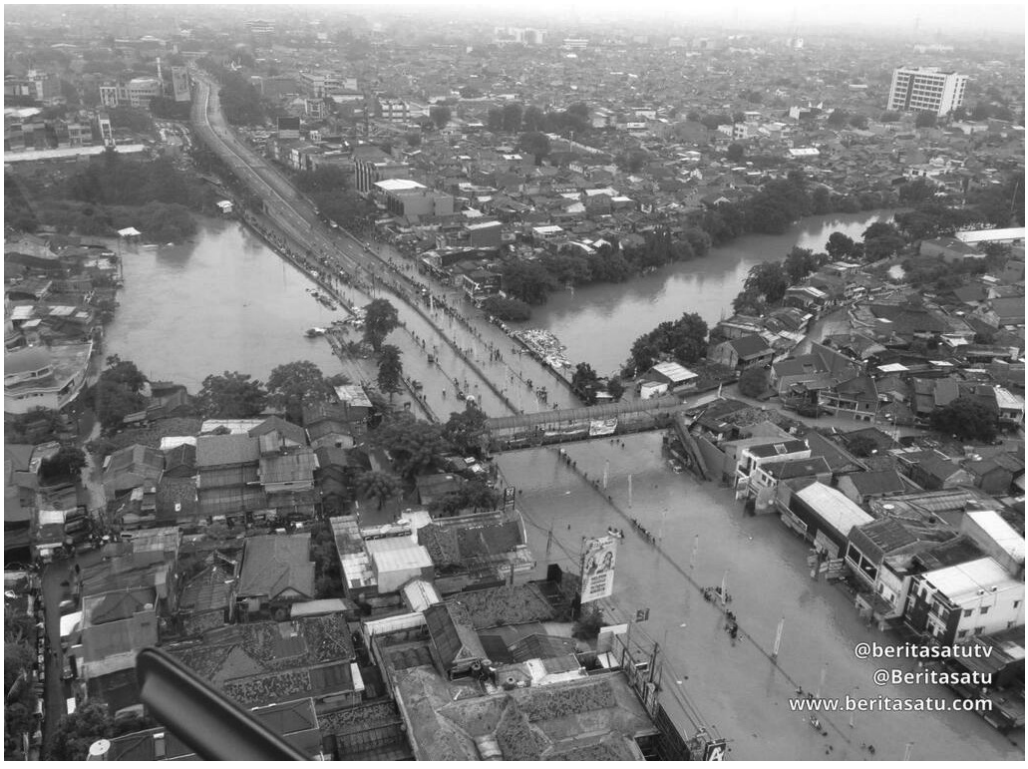

Figure 2
13 January 2014. Flooding in Kampung Melayu Sub-District, located at the south-edge of Weltevreden (literally meaning 'well satisfied'). The area used to be the centre of Batavia, the colonial city.

Photo: Beritasatu, Suara Pembaharuan

retention areas.[3] It is estimated that Jakarta should allot at least five per cent of the city's total area for water retention (Master Plan Jakarta 2030). Today there are 70 small artificial reservoirs and natural ponds, but their capacity has been decreasing due to sedimentation and illegal land reclamations. Even if functioning well, the total capacity of these existing reservoirs would not meet the minimum requirements estimated by engineers. In 2013, two reservoirs have been dredged and the embankments have been designed for new public space with parks and civic amenities, including an opera house.[4]

Unfortunately, the reservoir revitalization project has been causing the eviction of thousands of slum-dwellers who have lived on the site for at least for two generations. By the end of 2013, around 1200 'illegal' dwellers had been evicted from the banks and according to the plan, they would have be relocated to high-rise social housing units built in the area and two other sub-districts.[5]

Flooding has diverted public attention away from the slowly but continuously growing problems of declining water sources and inadequate wastewater management in Jakarta. While flooding always induces fast reactions from the governor to embark on new construction works – such as new dams, new canalizations, reservoir and lake

Figure 3
18 January 2014. Flooding is hampering operations in a food stall in a kampung of Jakarta

Photo: courtesy of Enny Nuraheni/ Reuters

embankments or reservoir dredging – it does not effect a serious response to the continuous flow of black water that creeps up in the urban area time after time and 'suddenly' becomes a serious problem during the annual flooding season. It can be estimated that 85 per cent of Jakarta's grey water[6] is disposed without proper treatment, while around 60 per cent of its black water[7] volume is discharged directly into the ground and into water bodies. Only two per cent of Jakarta's population is served by a centralized sewerage system and only half a million households use proper septic tanks for black water collection (data of 2005 in Miller, 2006). The annual flooding spreads the untreated domestic wastewater, thereby diffusing and increasing the incidents of water-borne diseases.

3.1. Black Water: a Central Issue Affecting the Quality of Urban Life

The presence of water, both as deadly and life-giving force, cannot be ignored (see Boomgaard, 2007). Unfortunately, management of the problematic water sector today has been led by the modernist approach that, in tune with the segmentation of the water cycle, divides the sector into different poorly cooperating fields of expertise. As a consequence, policy makers tend to prioritize their field over others and go for short-term and partial solutions. The solution of channelling storm water and removing away wastewater as quickly as possible from a certain place is widely implemented, without considering the effects on the environment outside the 'protected' or 'safeguarded' territory (see Silveira, 2001). One consequence of draining the city instead of holding, treating and absorbing water in urban areas is limited groundwater recharge, causing water scarcity.

Figure 4 illustrates the socio-ecological metabolism of water in Jakarta. It shows how wastewater flows in the city across both economic productive and re-productive spheres, how different segments of the water cycle cannot be separated from each other, and the correlation of these segments with the spatial distribution of settlements in the city. Not only does wastewater management have impact on the spatial quality of the city, it also matters for securing clean and drinking water provision at the neighbourhood level.

Many families living in Jakarta are not served by the state piped-water system. This observation, however, does not support the overly simplified thesis that formal settlements are necessarily connected to state-led piped water service while informal settlements, i.e. the kampungs, are not. Fragmented spatial development and geo-morphological conditions are only two among many factors influencing who has access to the network of (piped) water.

The state water utility network covers around 60 per cent of the Jakarta area (PAM Jaya, 2011) in which there are only around 800,000 piped-water subscribers and 2,000 registered

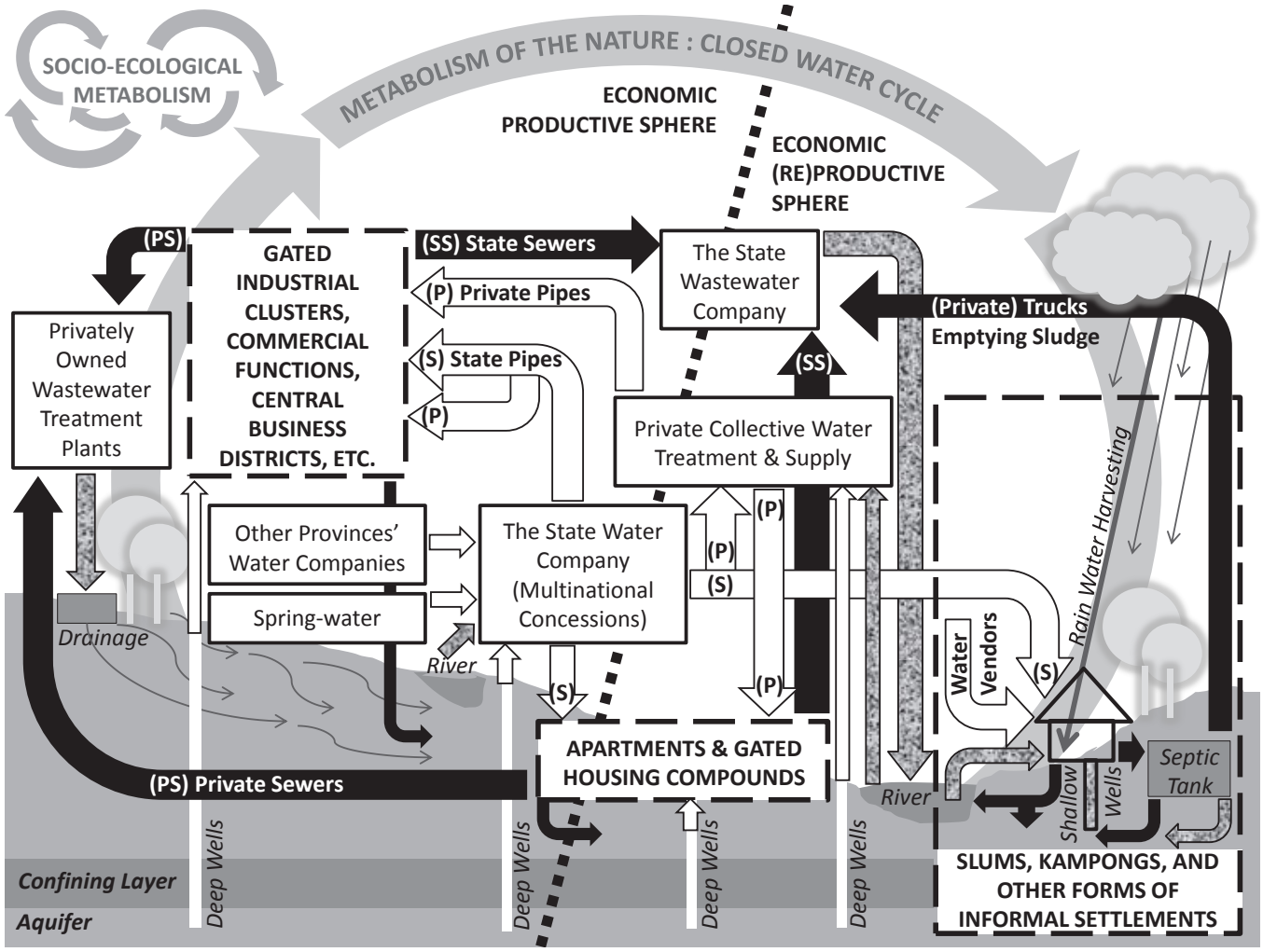

Figure 4. The Socio-ecological Metabolism of Water in Jakarta

Source: the author

users of public standpipes (Jakarta official statistic data 2010). Limited and unreliable service from the piped-water companies leads to the continuous utilization of groundwater by inhabitants of Jakarta. Many private companies have constructed deep wells from where they extract bulk volumes of aquifer water. This has been seen as the cause of land subsidence and saline water intrusion. Worsening the situation even further, the private sector has been extracting spring water from the hinterland to produce bottled water, a commodity that has not been fairly regulated in terms of price, access and the impact of plastic waste on the environment (see also Wilk, 2006).

In the kampungs, many types of community service have emerged and grown to partially fulfil the needs and rights of the inhabitants as regards water and sanitation services. Customized bottled drinking-water, non-piped water supply, and public latrines are commonly present. A large part of the kampung population acquires water from shallow wells (Kooy & Bakker, 2008; Sima et al., 2012; Yudiarso, 2010). But, little public sector investment in wastewater infrastructure (Miller, 2006) has led to the deterioration of traditional wells that is associated with increased risk of diarrheal diseases. Many shallow wells are polluted with E. Coli because discharging untreated wastewater, even faecal water, into open sewers, the ground and water bodies is not uncommon (Sima et al., 2012). Diarrhoea remains the leading cause of infant mortality and the third leading cause of morbidity in all age groups, as well as a leading cause of healthcare expenditures for young children (Ibid., 2012).

3.2. Jakarta and the Indonesian Sanitation Sector

The debates regarding the institutional and technological failures have been going on for decades, but until today there have been only few improvements in the water-sanitation infrastructure development compared to the globally agreed targets as formulated in the Millennium Development Goals (see Aguilar & De Fuentes, 2007; Loftus, 2009b; Satterthwaite, 2003). Although market and economic regulation frameworks have been failing to address problems arising from the specific conditions of poverty and informal settlements, many decision makers in public and donor agencies insist on applying them because no alternative policy frameworks and institutional arrangements have been adopted on a significant scale (cf. Gerlach & Franceys, 2010; Hardoy et al., 2005; Luthi et al., 2008; Ostrom, 1996; Parkinson & Tayler, 2003). The existing governmental system has not been able to valorise any alternative system. Likely, one factor behind this is that there is no synergy between the sanitation development strategies of public agencies, water-sanitation (private) operators, community organizations and donor agencies.

Some different approaches to sanitation development in Indonesia have been tried out (see Box 1 of Paper 3 for the trajectory of key national sanitation development programs). However, these are not much more than variations to top-down planning processes while on the ground, the implementation of development programs has always been centred on the goal of delivering physical infrastructures and not in an integrated manner of development.

Compared to other capital cities in Southeast Asia – Manila, Phnom Penh and Kuala Lumpur – Jakarta is lagging behind in the development of wastewater infrastructures (Kearton et al., 2013). The condition of the sanitation sector in Jakarta demonstrates the country's limited progress in sanitation development. Wastewater management has been the most neglected field in the Indonesian development sector. At all governmental levels, sanitation represents only a small portion of the government's budget (Colin 2011; WSP 2011). Although between 2006-2012 the national budget allocation for the sanitation sector kept increasing, by the end of the period, it had reached only 0.3 per cent of the total budget (Kearton et al., 2013).

The World Bank reports that the sanitation coverage in Indonesia is 57 per cent, which is lower than that of its neighbouring countries (Hutton et al., 2008; Napitupulu & Hutton, 2008). 'Sanitation coverage' means easy access to a 'private and safe place to urinate and defecate' (Napitupulu & Hutton, 2008; WHO-Unicef, 2010). The figure for the national coverage is quite biased if we consider that the 'coverage' does not include proper waste-water treatment. In urban areas, household faecal waste goes into septic tanks (59 per cent), pits (21 per cent), rivers, ponds, rice fields and lakes (13 per cent), and others, including sewer systems (7 per cent) (Blackett & Sukarma, 2005).

With little commitment from the government, the sanitation issue also receives little attention from civil society. The lagging sanitation service development is not a priority among non-governmental organizations – e.g. consumer groups, social movement organizations, etc. – and attracts little mass media coverage.[8] Yayasan Lembaga Konsumen Indonesia (YLKI), the Indonesian Consumers Organization, advocates a better service for basic infrastructures, but this is limited to electricity and water supply. Moreover, the organization's efforts are targeted only towards the people who are subscribing to the service provisions, and not to those who are excluded from the system. Sanitation does not make big headlines, and there will be wider coverage of reports on sanitation only if there is an extraordinary occurrence of sanitation-related diseases, like a cholera epidemic for example.

The socio-technological water management system introduced by the Dutch during the early development of Indonesian cities did not incorporate wastewater treatment systems. Batavia, the colonial name of Jakarta, was not planned with covered wastewater collection

systems. Instead, open ditches were built to collect both domestic wastewater and storm water (Ravesteijn & Kop, 2008). It was only in the 1920-30s, after a century of modern colonization, that the Dutch developed central sewerage systems for Bandung, Cirebon, Surakarta and Yogyakarta. But not all of the systems were connected to a treatment plant. After Independence, it was only in the beginning of the 1980s that the World Bank financed a project of the Jakarta Sewerage System, as part of the Integrated Urban Infrastructure Development Programme (see Box 1 in Paper 3). Today, only twelve cities (out of 414 cities and regional urban districts – *kota* and *kabupaten*) have centralized sewerage systems (Kearton et al., 2013). Many of the sewer networks only cover a tiny part of the urban areas and the treatment plants are under-utilized (Kearton et al., 2013; USAID, 2006) since households are not willing to connect their toilets to the main sewer trunks. For more information about the large-scale wastewater treatment systems in Indonesia, see Appendix 1 and 2.

Aware of the fact that the development of a centralized sewerage system has been making a slow progress, policy makers and donor agencies have begun to search for other models of wastewater management. Like in many other cities of the Global South (Medilanski et al., 2007; Parkinson & Tayler, 2003; Suriyachan et al., 2012), decentralized wastewater management has been re-introduced in Indonesia as an alternative to the conventional centralized sewerage system (Kearton et al., 2013). In 2003, a national policy framework of community-based sanitation development was launched for the first time (GOI & Pokja AMPL, 2003).

Despite a change of direction in policy making processes at the national level, knowledge of the water sector within the governmental agencies of DKI Jakarta is still very limited to practices matching the water management logic of the industrial complexes and welfare states of the North. Urban projects, that have been implemented or are still in the planning stage, are based on the premise that improvement of the urban living condition through better infrastructure provision relies on big capital investment (international funds and private sector involvement) while neglecting the role of social capital in community development and overlooking varieties in consumption norms. The recently developed Jakarta wastewater master plan proposes 80 per cent of the urban area to be served by centralized sewerage systems (Yachiko Engineering, 2012). With this master plan setting the target for 2050, it is unlikely that the effluent produced by millions of Jakartans will be safely disposed of any time soon.

4. URBAN KAMPUNGS: THE GREY SETTLEMENTS OF JAKARTA

There is no single definition of *kampung* in Jakarta. It is a socio-spatial entity embedding an economic production and settlement system that encompasses a broad range of informal income generating activities. However, it is not merely a spatial manifestation of the 'informal economy'. Kampungs are neighbourhoods where blue-collar workers from the formal sector and workers of the informal sector live together and their co-existence has been supporting the economy of the city as a whole. Many small business activities in kampungs are part of larger business operations and often the local entrepreneurs are highly dependent on bigger economic players (see also Simone & Fauzan, 2013). Like *favela* in Brazil, *barrio* in Venezuela,

callampa in Chile, *katchi abadis* in Pakistan or *colonia proletaria* in Mexico (see Hasan et al., 1999; Ward, 1976), *kampung* is one type of 'informal settlement' built by communities as active urban settlements.

Kampung can fall under the categorization of 'gray spaces', a term coined by Yiftachel (2009). These are spaces in which communities are only partially included in the urban polity, 'neither integrated nor eliminated', the territories that are formed through dynamic processes of 'group territorialities' and maintained 'from above' by 'a "politics of un-recognition" accompanied by marginalizing indifference' (Ibid., 2009, pp. 89-92). But these are also spaces that are formed 'from below', involving governance modes that incorporate several non-formal institutions for mediation and negotiation (see Chatterjee, 2004, pp. 53-78; Simone, 2012). While cities in the Global South are often conceptualized as 'informal' (Roy, 2005), defining or pointing out these 'gray spaces' brings a new analytical dimension to the discussion on urban informality, stressing how processes of sustaining urban inequalities are embedded in certain territories (cf. Yiftachel, 2009). Adding the concept of 'territory' is also important to understanding *kampung* not as a passive physical container but as a form of dynamic socio-spatial organization, in which different spatial strategies from different actors are continuously being contested (see Massey, 2005). Social networks of each actor are not isolated in such localities, but linked with wider territorial dynamics, e.g. the city, the region, the rural-urban relations, and the country (see Moulaert, 2000; Van Dyck & Van den Broeck, 2013) .

From time to time, the transformations of kampungs in Jakarta is relative to the dynamics of other urban spatial arrangements: e.g., gated housing estates, central business districts and manufacturing industrial zones (see Blackburn, 2011; Harjoko, 2009). The territorial borders of each kampung change continuously in relation to the state's development strategies. Many traditional kampungs – those that have emerged since the colonial era – have been eliminated and the remaining ones continue to densify and/or expand while new ones have emerged. Thus, one kampung can be older than the others, having higher population density and/or consist of multi-ethnic groups instead of being dominated by a single ethnic group. In short, kampungs embed heterogeneous populations and conditions.

No one knows (nor may ever know) the exact number of people living in kampungs or the total area of kampungs in Jakarta. The government of Jakarta has data of the total area and spatial distribution of slums. In 2008, the Public Housing Agency of Jakarta, *Dinas Perumahan*, reported the presence of around five thousand hectares of slums, forming almost 12 per cent of the total housing area in the city (Dinas-Perumahan, 2008). 'Slum' has been used by the state as a term to refer to the physical quality of settlements that are lagging behind in certain health and architectural standards, but this categorization does not represent the real characteristics of a 'kampung'. The term 'slum' in general is problematic because it does not invoke the problems of inequality (access to job, land and housing) and enhance the physical dimension (the shelter, drainage and toilet facilities) and also overlooks the socio-political dynamics (the people with extended social networks) (see Gilbert, 2007). In sum, the term has over-localized the situation and legitimized development policies supporting slum clearance (cf. Ibid., 2007). There is other data about the spatial distribution of poverty (e.g. Mercy Corps, 2008), but these also do not explain the characteristics of '*kampung'* in a comprehensive way.

The labelling of kampungs as grey settlements in this thesis has more than a metaphorical value; *grey* also describes the bio-physical condition of kampungs. Kampungs can be termed 'grey settlements' for their deteriorating sanitary conditions – lack of access to water supply, blocked drainages, unmanaged solid waste and untreated wastewater – as well as the lack of open green spaces. Nevertheless, it is interesting to observe that in kampungs too, many households possess good cars or well-built houses. Better-off households in kampungs, i.e. lower middle-class families who probably cannot afford houses in real estate developments, often solve their household environmental problems on an individual basis, but this does not help the overall neighbourhood living conditions. This fact exemplifies internal differentiations within communities in a kampung. The heterogeneity of kampungs has been overlooked by policy makers. Urban managers often see kampungs as a homogeneous collective entity and this has led to ineffective urban development strategies (see Bianpoen, 2011; Ingleson, 2012).

4.1. Tracing Back the Traditional Kampung: Lessons for Today

In colonial times, the indigenous word 'kampung' was used to label non-European and non-Chinese settlements. When European norms became dominant in Jakarta during the eighteenth century, the traditional practices of urban living did not completely disappear; the transplantation of the industrialization model to Indonesian cities during European colonization, the establishment of the modern state and the development of modern infrastructure networks were accompanied by a transformation of the 'original' agriculture-based inland and coastal settlements.

Early kingdoms of Java were built in inland areas surrounded by conurbations of agriculture communities that were also protecting the kingdoms (Christie, 1991; Ford, 1993; Reid, 1980; Widodo, 2004). When the population grew and passed a certain size, most of the villages were divided instead of growing into high-density areas (Christie, 1991, 2007). New clusters were built at the edge of the old village and ruled autonomously (Christie, 1991).

It can be argued that there was a relatively solid system of pre-colonial water management in Java for agricultural needs and dealing with floods, managed either by the states or communities, in which certain types of collective provision were practiced. The first tradition to engineer water in Java was in the form of irrigation that was presumably spread during the Hindu civilization (cf. Ambler, 1988; Hunt, 2007). The irrigation system was the heart of traditional agricultural communities; it was the product of institutionalization processes in agricultural societies as well as a means to structure the socio-economic production cycle (Lansing, 1987).

Traditional agricultural institutions varied in terms of size and mechanisms, e.g. networks of small entities or large centralized systems. Each of the institutions had a different degree of autonomy vis-à-vis the state bureaucracy, in other words there were different degrees of state intervention (Ambler, 1988; Christie, 2007; Hunt, 2007; Wolters, 2007). Most traditional irrigation systems were communal, collectively managed and built through bottom-up initiatives. Kingdoms mainly organized water works in the forms of flood canals in the vicinity of the palaces, transportation canals connecting inland settlements to seaports and water works for religious purposes, for example water temples and sacred dams (Brummelhuis, 2005; Christie, 1991, 2007). However, the kingdoms benefited from irrigation systems as they derived revenue from the production of rice under irrigation (Christie, 1991).

Extensive state involvement in water works, including for agriculture, started only when the kingdoms settled in or used delta regions more extensively due to the growth of international trade (see Christie, 1991; Christie, 2007)[9]. Living in delta areas required better organized water works due to more abundant water (Christie, 2007). When the states started to settle in delta regions, agglomerations grew with higher density and farmers were highly encouraged to open wet-rice fields (sawah) along the coast (Christie, 1991). New irrigations benefited the states not only through increased taxes and ensured food security, but also because there was a better control over the coastal communities; people were anchored around paddy-fields as in the inland areas (Christie, 1991, 2007).

The socio-spatial organization of Javanese villages and settlement agglomerations were always in a state of flux and there was no unique concept of territorial demarcation as a basis of community formation; the power of a sultanate, a kingdom, or a nobleman was measured not based on the size of land in his domain, but on the number of people and subservient peasants under his influence (Kusno, 2006). With high levels of political fragmentation that stimulated the rise of several small centres and their competition for dominance (Christie, 1991; Reid, 1980), agglomerations were not growing towards bigger urban centres as in other political contexts (such as Mesopotamia, ancient China, or medieval Europe) (cf. Reid, 1980; Taylor, 2012).

With this pattern of spatial configuration, water management for (urban) domestic needs, i.e. water supply and wastewater treatment system, was not equally advanced as for agriculture and coastal drainage system. The level of population density and diverse patterns of dwelling agglomerations (for traditional-religious principles of spatial use, see for example Aranha, 1991; Samadhi, 2004; Waterson, 1997) led to a simple yet complex domestic water management (see **Figure 5**). The water and sanitation needs could be satisfied with rivers, springs and other self-purifying natural elements. Houses were elevated, in part in order to

give some space for water to flow beneath the structures while infiltrating to the ground. Thus, the arrangement of the *micro-cosmos*, the housing, was not separated from the *macro-cosmos* of which the agriculture fields and the river systems were part (Lansing, 1987; Waterson, 1997; Widodo, 2009). Like land, water was a common (re)productive good.

Not to romanticize the past, the current situation is a new hybrid in which any past solution, in its old form, would never be suitable for contemporary problems. I tend to see, however, that to some extent the relatively autonomous traditional communities were able to cope with ecological problems and to face some uncertainties like wars and volcanic eruptions. Even if they were often evicted, it seems that they managed to re-settle together with relative ease (compare with Christie, 1991; Reid, 1980; Taylor, 2012). Within the modern era, there has been little room for the communities to survive without breaking their traditional networks, and to maintain their productive socio-ecological landscapes when facing more powerful outsiders.

Figure 5.
Water cycle in traditional kampungs
Source:
courtesy of Tizar AF

4.2. The Kampungs and Contemporary Jakarta

Jakarta today, post-colonial Batavia, constitutes one of Indonesia's 33 provinces. It is surrounded by four urban regencies that together accommodate the largest urban population concentration in Indonesia, commonly known as the Jakarta Metropolitan Area (JMA) (see **Figure 6**). Around nine million people are currently registered as residents in Jakarta province and around 27 million in the JMA (the 2010 national census). But it is estimated that the

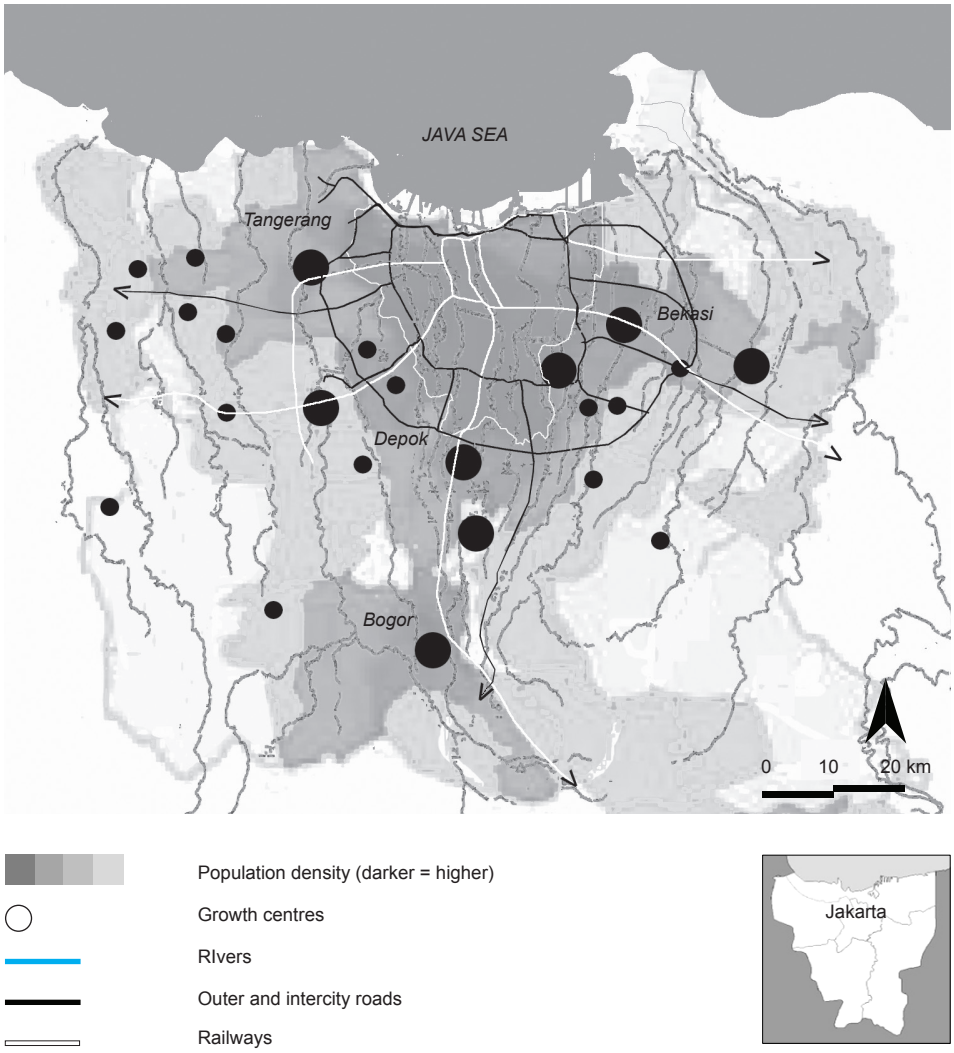

Figure 6.
DKI Jakarta and the greater metropolitan area
Source:
re-drawn by the author based on several maps

actual numbers of these populations are much higher, taking into account the presence of floating population. The latest wastewater master plan was developed based on an assumption that Jakarta has a population of at least thirteen million people (Yachiko Engineering, 2012). They spread across several centre-periphery systems that follow the distribution of several economic nodes (see Goldblum & Wong, 2000). The four urban regencies are growing faster than Jakarta, and accommodate around 1.5 million daily commuters with activities in the capital (Firman, 2011).

In the 1980s, the (upper middle class) population moved from the city towards the periphery and new satellite towns (see Dorleans, 2000). These economic and demographic trends continued in the 1990s (see Dorleans, 2000; Goldblum & Wong, 2000). The spatial planning system has been unable to steer the spatial development processes (Cairns, 2002; Dorleans, 2000; Evers & Korff, 2000; Van Roosmalen, 2005). The city's prestigious business enclaves and gated settlements are scattered among poorer urban settlements or kampungs. Many of these developments fail to comply with the metropolitan master plans (Goldblum & Wong, 2000).

Massive sprawl, especially on higher ground in the southern areas of Jakarta, affects the city's ecological landscape in various ways (Argo & Firman, 2001): 1) less water flows back into the ground, causing water sources, e.g. wells, to dry up; 2) excess water from high precipitation causes flooding in downstream areas; and 3) as the domestic wastewater produced in industrial and residential areas is not treated in a controlled manner, if at all, the surface water flowing into the city is highly polluted. Apart from their depth, which is in correlation with the construction cost, the quality of wells varies also because of their geographical location. In general, communities occupying the southern part of the metropolitan delta can fetch better quality of groundwater compared to those living in the lower areas. However, the impacts of sprawl on the urban environment of Jakarta are harming especially those of lower middle classes and the urban poor.

Adding to the heterogeneous socioeconomic conditions caused by varied income structures, several types of land tenure coexist due to various forms of informal land occupation. There are contradictions between traditional, colonial and post-independence laws that perpetuate unpredictable titling, tenure, and enforcement systems in Indonesia (Sheppard & Mohamed, 2006; URDI & Mercy Corps, 2008). In 1988, 45 per cent of the population claimed to be land owners, but 70 per cent of this group actually held unregistered land (Hoffman, 1992). After more recent research in two kampungs, URDI and Mercy Corps (2008) reported that approximately 57 per cent of the land owned by people in these communities is unregistered. The Indonesian authorities consider unregistered, formerly traditional land

holdings to be legal. Another type of land holding considered quasi-legal is where the land is owned by the state or others, but the local government has authorized occupants to use it, as long as they abide by certain set obligations (see Hoffman, 1992). Some large housing estates organized by private developers employ this type of land tenure.[10]

Around 70 per cent of Jakarta's residential buildings are self-built (URDI & Mercy Corps, 2008) and many of them are built on unregistered lands (Hoffman, 1992). Housing of this type can be found in urban kampungs and very often was built without permits to ensure the standard of building quality.[11] As such, the communities in kampungs are prone to eviction, because developers are eager to buy the cheaper unregistered lands and replace the low-valued buildings there with housing estates and/or commercial functions (see Hoffman, 1992; Sheppard & Mohamed, 2006).

5. THE BUILD-UP OF THE PHD THESIS

5.1. A Methodological Reflection[12]

Sayer (1992) reminds us that method is not only for empirical research but also includes critical question of theorizing. The term method cannot be reduced to techniques for information collection and interpretation. Method should also explain our process of abstractions in conceptualizing the reality that we consider as problematic (see Harvey, 1973, p. 314 ; Sayer, 1992). Harvey (1973) points out that apart from the need to know how knowledge is produced, we need to understand what is served by producing the knowledge.

In my research I follow Sayer's triangle model with three corners that are 'method', 'object', and 'purpose of study' (Sayer 1992, see especially pp. 4, 257) and show how these corners need to be coherent (Sayer, 1992, pp. 232-257). Sayer argues that we need to re-assess the unreasonable orthodox aims of science, that is to have 'scientific objective proportional knowledge which provides a coherent description and explanation of the way social world is' (Sayer 1992, p. 233). Arguments as to whether research is objective or not perhaps become irrelevant if we are clear on what the aim of the research is, to begin with.

It was not my main intention to document extensively the practices of communities in providing water and sanitation services so that we recognize the locally-developed patterns of 'good' and 'bad' stories. Such an extensive research is certainly interesting and important, but would not sufficiently explain the totality of the water sector in Jakarta (see Sayer 1992, p. 237-251 for discussion on types of research and the aims of social science). The general

aims of this PhD research are to: *i) explain the origins of disparities in access to water and sanitation*; *ii) assess the contemporary governance dynamics*; and *iii) open an alternative path for imagining and building a future in the provision of water sector infrastructure*.

My starting point to address above aims was based on a basic understanding that researching the water and sanitation sector reveals interplays within society and the relationships between human and non-human actors. Human-human and human-nature relations are mutually determinant, and these two interrelated social relation types are constitutive of the constructions of urban space. I argue that we fundamentally need to answer the following questions: 1) How are these two interrelated social relations types simultaneously constructed? 2) What determines the changes in these relations that supposedly influence the socio-technological system of water management?

My first approach in seeing the subject of study was very much influenced by the literature of Urban Political Ecology (UPE). Scholars have developed UPE partially to understand that urban environmental problems and inequalities of access to water among urban populations are part of greater ecological problems and related to broader socio-political dynamics (among others, Gandy, 2008; Loftus, 2009b; Swyngedouw, 2004; Swyngedouw et al., 2002). UPE rejects studies arguing that water crises as problems merely caused by inadequate adoption and implementation of modern economic techniques of ecological management, including valuation engineering techniques of exploitation on one side, and conservation on the other side (cf. Robbins, 2004). The political ecology of water supports the principle that everyone should be able to live in an environment free from daily injustices of stagnant and polluted water sources and enjoy equal distribution of potable water (Loftus, 2009). At the same time, UPE proponents argue that achieving this ideal is neither socially nor ecologically neutral because certain power geometries involving human and non-human actors are materialized in the processes of securing access to water (Swyngedouw & Heynen, 2003; Swyngedouw et al., 2002).

While UPE explains very well the unity of the metabolism system within multiple temporal dimensions, as far as I have explored the literature body, I found its empirical categories rather weak in explaining the power geometries at play within a relatively micro scale socio-ecological configurations. For example, the analytical elements within UPE are not sufficient to examine the sanitation infrastructure development processes in Jakarta, characterized as it is by the interplays between different governmental tiers as well as between governmental- and non-governmental actors, including agents within both the formal and informal economy. There has been a call within UPE to examine the production of everyday environment in order to recognize the conditions that can spur possibilities of

radical alternatives (Loftus, 2009b). However, answering this call necessitates analyses of the interplays between the governance dynamics at the metropolitan level and the socio-ecological dynamics of communities, typical environmental strategies of actors in different places and the interactions between the strategy implementations, and many other research problems that are better addressed by accompanying UPE with theories having different kind of explanatory power. Indeed, many UPE scholars have raised the fact that, under the capitalist mode of production, there are certain forms of social relations that impede more sustainable practices in (urban) development (e.g. Cook & Swyngedouw, 2012; Loftus, 2009a). But, we need to know further how this kind of social relations is operating over time and only through this understanding, some milestones for moving towards better processes of sanitation development can be defined.

Hence, I elaborated the perspectives of UPE with those found in some literatures on socio-economic institutional dynamics. Many of these studies have been built on a solid understanding for theorizing the elements of 'society'.

It has been a long journey of theorizing the relationship between the individual and the bigger group named society or between what is conceptualized as 'agency' and 'structure'. This journey has not been free from ontological, epistemological and methodological problems (see Hodgson, 2004; Jessop, 2005; Moulaert & Mehmood, 2009). The PhD thesis is developed upon a premise that reality consists of layered structures; that each level contains several emergent properties formulated from lower level entities. These layers of structures (social, natural, biological and physical worlds) have certain autonomy and stability but are still connected to each other (see critics to Giddens from Bhaskar and Archer in Hodgson, 2004). Lower level entities have characteristics of properties that are not simply mirrored from the emergent properties. On the other hand, the characteristics of the emergent properties cannot be simply represented by the lower level entities (Hodgson, 2004; Jessop, 2005). Not to dwell only on one dimension of the relationship, whether individuals/ agencies or the society/ structure directing the social relations and transform the other, a framework that allows adequate explanation for both structural and individual transformation is needed (Hodgson, 2004).

Some scholars have been explicitly conceptualizing institutions and institutional dynamics as part of the analytical tools to examine mutual relationships between actors and structures as well as to explain individual transformations (for surveys, see Moulaert & Mehmood, 2009). Institutionalism, in my opinion, brought debates on the relationship between agency and structure into a concrete or operational analysis because it recognizes several different politics of scale. This recognition has enhanced our understanding that 1)

structures give significant impacts on certain individuals instead of all individuals, or in other words, different groups of individuals are structured differently; and 2) different groups have different capacities for institutional/ structural changes.

I made an exploration in my research methodology by mobilizing Agency-Structure-Institution-Discourse (ASID) framework (Moulaert & Jessop, 2006) (see my summary, Table ASID in Appendix 3). Each cell within the table is not operating independently. Instead, there are interactions between cells. However, each column/ row can be applied independently as a tool of analysis. To sum, specific structures emerge from the relations of human-human and human-nature relationships. In turn, these emergent structures affect the two types of social relationships. The nature-human-economic structure formations also lead to complexities in relations with other structures e.g. structures mediated by socio-cultural institutional dynamics. Informed by insights obtained through the exploration, I further addressed the coexistence of multiple socio-ecological structures within specific spatial and temporal dimensions. I began by an exploration of the concepts 'city', 'urbanism' and 'urban metabolism'.

There are clear differences between 'urbanism' as a social form and 'city' as a built form. Urbanism contains social relationships with several coordinating mechanisms to maintain necessary relationships (Harvey, 1973); a certain mode of urbanism represents a certain mode of production of social, political and economic integration in the productive and reproductive sphere (Harvey 1973, p. 203-206; Mingione, 1991). A city as a built form is in part 'a storehouse of fixed assets accumulated out of previous production' (Harvey 1973, p. 203). It is very possible that two similar built forms represent completely different social forms and/or modes of urbanism (Ibid., 1973). Swyngedouw (1999, 2006) develops a concept of 'urban metabolism' that emphasizes the ecological dimension in the concept of urbanism. Necessary metabolism processes sustaining a city depend on the activity of working, in its broadest sense. By working, humans transform material objects, just as their own metabolism does within the body. Therefore, city life comprises on-going chains of material transformation that exist within certain social relations; through these chains, certain social relations are maintained (see Swyngedouw 2006). A city is a spatial manifestation of 'heterogeneous assemblages' created by continuous dynamic ecological relationships between humans and nature that are not neutral from the dialectics of human perception, conception and sets of meaning.

I recognize that behind the fragmented society in Jakarta, there are combinations of various socio-economic structures related to a highly differentiated 'work' system. I found the work of Mingione (1991) a robust foundation for this PhD research to explain the role of informality in urban society as he analyses the heterogeneous household income structures

in relation to the monetary system and wider governmental dynamics. In addition, other (contemporary) studies (e.g. Kesteloot & Meert, 1999; Roy, 2005, 2010; Simone, 2012) provide constructive insights to understand different facets of informality. Informality in the Global South is not only spatially expressed in enclaves of informal settlements, high mobility and temporal land occupations (see Evers & Korff, 2000; Miraftab, 1997; Oz & Eder, 2012; Roy, 2010), but also takes the form of an economic production system that encompasses a broad range of informal income generating activities (Castells & Portes, 1989; Mingione, 1991), as well as governance modes that incorporate several non-formal institutions for mediation and negotiation (see Chatterjee, 2004, pp. 53-78; Simone, 2012).

In the 'informal' cities of the global South, people have organized their own water and sewage disposal outside the domain of the state and big private enterprises. Since there is a clear relationship between the classification of urban residents, the differentiation of urban spaces and lack of access to services (Kooy and Bakker 2008), we can identify the locations of these practices easily within the fragmented Indonesian urban spatial development. These initiatives are mainly happening within so called 'disintegrated areas' that are being disconnected from prosperous economic activities, having disrupted local social capital, having low quality urban services and being excluded from the policy making process (see Moulaert et al., 2009). Jakarta's urban kampungs have such characteristics of disintegrated areas.

The fragmented physical configuration of the informal city is not a matter of 'disruptness' or of being 'disorganized' (see Mingione, 1991, p 117). It is rather the parallel manifestation of several spatial organizations that represent certain structures and scalar configurations. The structures that maintain the socio-ecological processes of the urban metabolism operate internally and at the same time, (re)producing several scalar configurations that exist simultaneously (see Swyngedouw, 1997). Whatever the geographical scale, there is always an otherness that exists outside the dominant space that contains the dominant sets of social relations. Indeed, space is divided, but not reduced into bounded territories. Space is structurally divided by sets of natural or social realities; each set of social relations operates over a certain time-span and within a concrete spatial context (see Moulaert & Jessop, 2006).

It is important to understand that 'city' as a manifestation of temporal-multiple spaces has an open future (Massey, 2005). There are continuous processes of 'becoming' are generated by the 'inherent instability' of the social relations; the social structures that direct social relations are necessarily relative, relational and temporary. However, the openness of the future is not defined by coincidences; the future is always path-dependent, shaped

by a cycle of successive adjustments driven by certain interest groups to stabilize-destabilize the paths (Mingione, 1991). In other words, there is an open, continuous process of 'creative destruction' and 'destructive creation' (Swyngedouw & Heynen, 2003). Hence, it is important to recognize conjunctures, spatial and temporal moments, that might open opportunities to produce institutional changes (see Moulaert & Jessop, 2006).

Recognizing such conjunctures for changes, have been one element of the analytical focus developed by scholars researching on social innovation. Social innovation research concerns with the needs to improve, both in an economic and social sense. It is on social innovation that the potential for change lies. Social innovation emerges from mechanism of crisis and recovery, efforts to overcome exclusion from formal decision-making and low quality of life, and with the goal of community needs satisfaction and (re)building the social fabric of communities and society (Moulaert et al., 2009; Moulaert et al., 2010). The concept of 'social innovation' I discuss here contains 'sustainability' because it necessitates institutions for enabling and maintaining collective actions for both short- and long-term needs satisfaction.

For the purpose of unlocking an alternative path for building better future in the provision of water infrastructures, I explore the concept of 'social innovation' within the context of 'water governance'. My PhD research seeks to understand the desired changes within urban water sanitation sector within the contested urban territorialities in Jakarta. Producing a sustainable city necessitates involvement of relevant social actors at multiple geographical scales while society and its communities are the fundamental engine to organize alternative development approaches (see also Moulaert et al., 2009; Moulaert et al., 2013; Moulaert et al., 2010). Development progress in the water and sanitation sector is very often measured by the number of people having individual access to piped water and centralized sewers. But instead of providing technical solutions only, a more fundamental development goal should be pursued: communities should be able to secure their water resources and improve the quality of their local habitats.

To conclude, the dialogues between *the four theoretical bodies of Urban Political Ecology, the literature on Institutionalism, Informality and Social Innovation* have proposed an agenda for socio-ecological change. This four-theory elaboration can be used as critical tools in answering the main research questions of my PhD research. The UPE provides the holistic approach to human-nature-societal relations; Institutionalism provides an understanding about the operations of human-nature-societal relations; Informality helps to address specifically the interactions between the capitalist mode of production, including the processes of producing (water) culture and living environments, and other modes of production; Social Innovation guides the agenda for change, moving towards a new assemblage of human-nature-societal

relations. I find the elaboration enables the research to define at least three important areas: informal institutionalization processes of practices in meeting water and sanitation needs, the formal state-led planning and development systems, and the spatial interactions between them. On a theoretical/methodological level, the elaboration contributes to the planning literature by developing an analytical framework that is able to detect power geometries at play within relatively micro scale socio-ecological configurations, and to find ways in bridging local initiatives with larger institutional context as well as global development practices and discourses. On a practical level, the theoretical dialogue opens up possibilities to develop critical tools to incorporate informal institutionalization processes of practices in meeting water and sanitation needs within the state-led planning and development systems. In the following sub-section I recapitulate how the elaboration has shaped the formulation of different papers.

5.2. The Papers and Their Theoretical Underpinnings

The first paper offers a framework for studying the co-existence of different modes of water and sanitation provisions in cities of the global South that are highly characterized by different forms of informality. It seeks to explain the complex configuration of socio-ecological conditions from which the diverse water and sanitation services emerged. The above mentioned four theoretical bodies have been put into dialogue to elucidate the discrepancy in access to water and wastewater infrastructures by different neighbourhoods and communities that is inseparable from the reproduction of the inequalities in Jakarta. The framework consists of three interrelated layers of explanation to disentangle the formal and informal institutionalization processes within the urban water sector as well as their multi-scalar and overlapping territorialities.

The first layer unravels the production of contemporary waterscapes in cities of the Global South, as a multi-stage historical transformation resulting from the interaction between formal and informal actors in different socio-ecological spaces. The theoretical-empirical discussions deconstruct the modernist logic of infrastructure development as well as the colonial/postcolonial and formal/informal divides. This explanatory layer is used to understand the interwoven meshes of water networks as socio-ecologically embedded.

The second layer explains the informal practices and dynamics of water and sanitation development at the neighbourhood level. The work of Mingione (1991) is used as the foundation to revisit some other studies on informality due to his robust explanation about different interactions between wide ranging regulations of an associative kind and

the diffusion of informal activities as reactions to industrialization. His robust explanation is very helpful in analysing the contemporary condition of urban kampungs, in which different institutionalization of water and sanitation services are overlapping.

The third layer analyses the reproduction of uneven access to water and sanitation through different institutionalization processes of collective spatial practices: the formal state-led and corporate sector driven spatial planning system, the real estate driven middle class urban settlement development procedures and the informal practices in urban kampungs that are reproduced in the grey area between regularization and informal institutionalization. The development and application of this analytical layer are informed by the literatures on socio-economic organization of cities (e.g. Lambooy & Moulaert, 1996; Moulaert & Jessop, 2013; Saunders, 1984) as well as some studies on neoliberal agenda in urban infrastructure development.

The second paper reveals the history of environmental sanitation in Batavia (Jakarta in the Dutch colonial era) in relation to the latter's development beyond the trajectory of modern colonialism. The paper explores the reasons why there has been a very low level of collective satisfaction of basic sanitation infrastructure needs. Through learning from the past, it highlights some key spatial development issues that are important to address. This paper is informed by various insights that have been used for analysing unequal access to basic sanitation services by debating contemporary conditions and reviewing history. It challenges the orthodox historical narrative and adopts a critical historical approach that questions everyday assumptions of 'planning' to open up creative possibilities for change (see Huxley, 2010; Sandercock, 2003). It seeks alternative planning histories that can be revealed by looking beyond the modernist planning paradigm.

The third paper addresses three urgent issues in planning and development processes of the sanitation sector in cities of the Global South. *First*, the state has not responded properly to the sanitary conditions of the informal settlements. *Second*, the environmental sanitation problems have been treated as if household sanitary needs were disconnected from the whole city and river basin systems. *Third*, the absence of a good governance system in which national and local governments are strong regulators. This is necessary for involving various actors, including the communities themselves, in improving sanitation service provision. This paper provides a critical look on the general trajectory of urban sanitation development in the Global South that has been highly influenced by the capitalistic regularization agendas. It is informed by some different streams within the wide-array literature on water governance (among others, Allen, 2010; Bakker, 2003; Bakker et al., 2008; Gerlach & Franceys, 2010; Loftus, 2009b; Ostrom, 1997). This paper is developed without omitting the insights formulated in the

previous papers. It avoids focusing the explanation on the roles of the state and the market, but instead, reveals the overall urban metabolism process and discusses the urban ecosystem as jointly biological, social, anthropogenic and geomorphic.

The fourth paper explores the possibility to integrate water management and spatial planning processes in Jakarta. It argues that the integration has to prioritize wastewater management, the most neglected activity within the water sector, and should simultaneously be pursued at the city and at the neighbourhood level. It seeks to understand the conditions under which community-driven local development initiatives can sustain. It discusses a direction for strategic projects, based on an urban design method and a socially innovative approach to co-production. This paper deploys the works of scholars that have been working on the intersect between 'social sustainability' and 'social innovation' (Mehmood & Parra, 2013; Parra, 2013). These literature body is used within a framework of strategic planning (Albrechts, 2006; Faludi, 2000).

5.3. Complementary Case Studies

The main case studies for this thesis are located in Jakarta. However, because very little commitment has been made for the sanitation sector development, best practices of decentralized wastewater management systems remain limited in Jakarta. To enrich this research, some global case studies have been brought into the discussions (see Paper 3 and 4).

In Jakarta, deciding on which kampungs to examine closely was not easy. The basic idea was to understand what was taking place on the ground in the water sanitation sector, instead of evaluating a certain technological model and/or studying the limitation of its implementation. I assumed, however, that the works of some organizations would lead me to the most relevant cases. Apart from the provincial public housing agency (Dinas Perumahan) two NGOs were considered to be important players. Mercy Corps has been working on the issue of urban poverty in Jakarta for years, and specifically on the sanitation issue, including decentralized wastewater management. KRuHA (People's Coalition for the Rights to Water) has been advocating poor communities with lack of access to piped water and demanding re-nationalization of the water companies through media campaigns, public petitions, legal actions, and protests.

At the end, Kampung Kojan that was the working area of Mercy Corps was selected as the first case study. In addition, I visited two other kampungs with my supervisors as well as the staff of Mercy Corps and Dinas Perumahan. One of the studied kampungs is not covered in this dissertation, and was replaced by another kampung that was examined through a

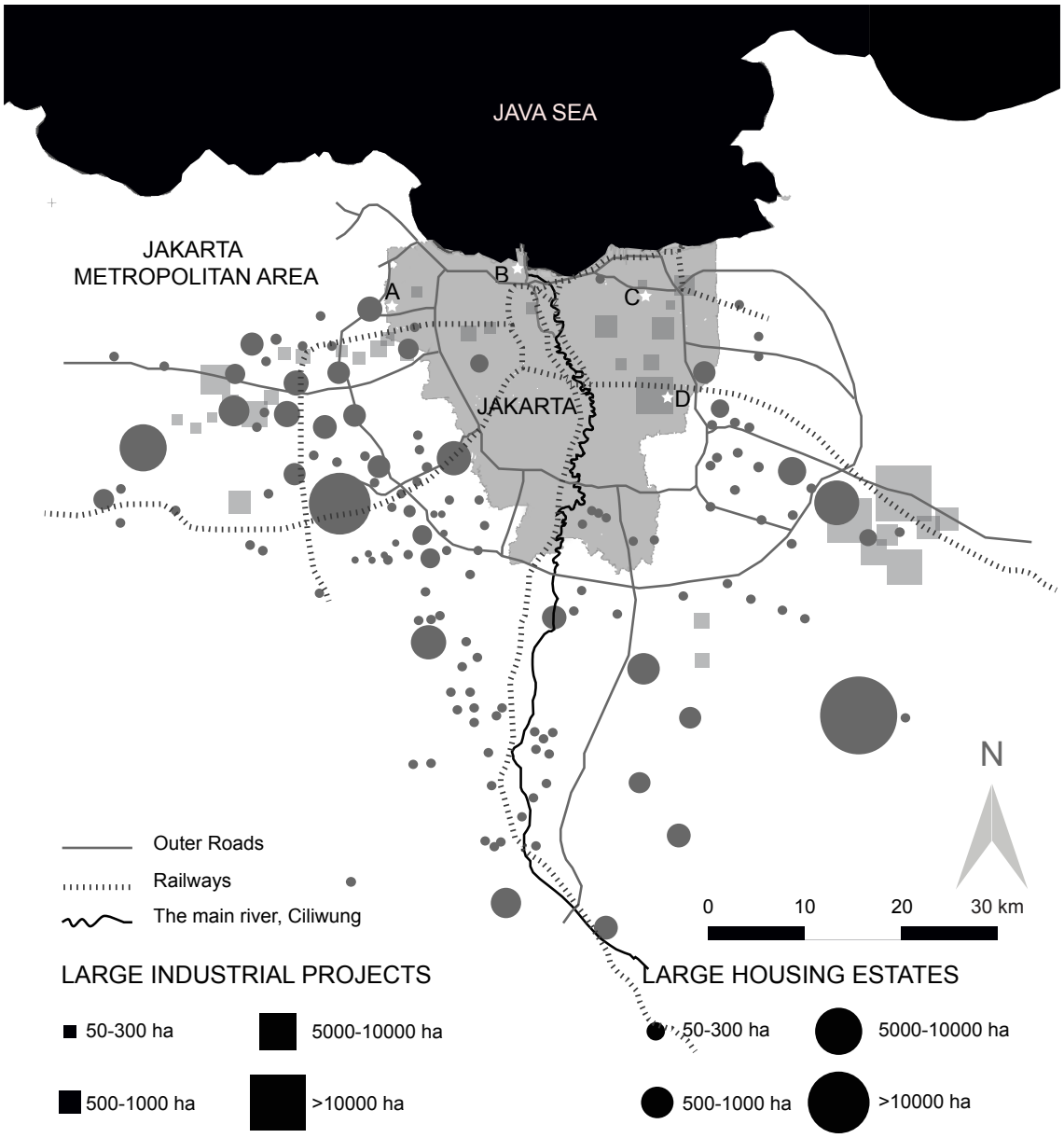

Figure 7. Jakarta Metropolitan Area and the four settlements:

A. Kampung Kojan, B. Kampung Muara Baru, C. Kampung Tugu Selatan, D. Perumahan Malaka Sari

Source: re-drawn by the author based on the study by Winarso and Firman (Firman, 2004, 2009; Winarso & Firman, 2002) as well as data and maps from Master Plan Jakarta 2030

study from secondary sources. I also visited a cluster of housing estates, a '*perumahan*', where the government had provided a decentralized sewerage system. These additional neighbourhoods, two other kampungs and one perumahan, play the roles of complementary cases to Kampung Kojan, which is the main case study that has been studied in detail.

These four settlements form parts of different '*kecamatan*' (districts) and '*kelurahan*' (sub-districts) of three municipalities of Jakarta. A sub-district is the lowest state administrative level that consists of two levels of neighbourhoods units, the larger Rukun Warga (RW), and the smallest one called Rukun Tetangga (RT). The presence of the two neighbourhood units is legally regulated as they have been part of the controlled political sphere established by the state since the Japanese colonial era (see Kusno, 2006); these units, together with sub-district and district, are mentioned in every citizen's official address. Although their presence is regulated by law, RW and RT have a certain degree of autonomy and the involvement of community members in their daily activities is voluntary-based (see Dwianto, 2003; Kusno, 2006). How these neighbourhood units operate and how their leaders are selected depend on how the (preceding) socio-political configurations have been (trans)forming at the very local levels (see Dwianto, 2003; Logsdon, 1978). Delineation of a kampung or perumahan does not always coincide with the delineation of formal administrative units, and in everyday life, local inhabitants and officials tend to use the original names of kampungs and perumahans.

The four settlements are located in the periphery of Jakarta, as shown in **Figure 7**. The perumahan is developed in the south-eastern higher land by the state housing company for a lower-middle class community. The three kampungs have been growing in the northern zone of the low land. Like a typical kampung in Jakarta, they are surrounded by factories, warehouses, logistics providers and supply chain industries, as well as gated housing estates. **Table 2** summarizes general conditions of each settlement, the development projects discussed in this dissertation, and the main sources of data.

Kampung Kojan (A) has existed for much longer than the various industries that have grown over the years in its surroundings. From interviews with community, the population of the kampung includes at least four generations. Its cultural-political constellation is dominated by the Betawi people that are acknowledged as the original ethnic group of Jakarta. Naturally, most neighbourhood leaders and landlords of the workers' rental houses are of Betawi origin.

Kampung Muara Baru (B) was originally occupied by workers of a sugar cane plantation in the 1960s (Yudiarso, 2010). When the fishery harbour was built in the 1980s and the area was filled with factories, the kampung became the home of many manufacturing industry workers as well as the home of its own informal economy (Ibid., 2010). It is interesting to note that households in this kampung have official addresses although they are considered to be illegally occupying the Pluit flood retention dam. In the future, due to the dam's revitalization program, the government is likely to evict this community, despite local resistance.[13]

Tugu Selatan Sub-district (C) consists of six units of RW of which five are categorized as kampung and one is part of a large gated housing estate, *Kelapa Gading*. This large enclave of kampung is probably the youngest settlement discussed in this dissertation. According to one community leader, even in the 1980s, there were still empty lands in this neighbourhood; in the early 1990's

many households who mostly had lived in other parts of Jakarta began to occupy this area after purchasing lands from the local *Betawi* families (interview 3f). The kampung of *Tugu Selatan* does not have a traditional name, which is typical for the kampungs which began to densify from the 1980s onwards. Hence, communities refer to the RW number and the name of the *kelurahan* (sub-district).

The housing estate *Perumahan Malaka Sari* (D) was built by the national government in 1975 to house low-cadre civil servants and military personnel. Many original owners have passed away or sold their houses (interview 3e), thus compared to earlier decades, the nature of this settlement has become more heterogeneous.

Table 2. The four settlements and the analysed development projects

Name of the settlement	*Municipality/ District/ Sub-district*	*Administrative delineation of the settlement*	*Area (+/- hectare)*	*Population/ households*	*Previous development project referred in this paper* *(completion year)*	*Main source of data*
Kampung Kojan (A)	West Jakarta/ Kalideres/ Kalideres	15 units of RT in RW 06	15.77 ha	6,000 people/ 1,500-1,700[a]	Program of Urban Sanitation & Hygiene Promotion (PUSH) with the construction of improved 219 septic tanks (2010) GPOBA water connection for poor households (2009)	Intensive field visits (May-December 2011)
Kampung Kebon Tebu, Muara Baru (B)	North Jakarta/ Penjaringan/ Penjaringan	3 units of RT in RW 17	12.3 ha	16,500-30,000 people[b] / 4,000[b] - 6,800[c]	GPOBA water connection for poor households (2009)	Previous study of a master thesis (Yudiarso, 2010)
Kampung Tugu Selatan (C)	North Jakarta/ Koja/ Tugu Selatan	5 units of RW	74 ha	16,500 people/ 4500[d]	A kampung improvement program called *Perbaikan Kampung Terpadu* (2008)	One day group field visit in May 2011
Perumahan Malaka Sari (D)	East Jakarta/ Duren Sawit/ Malaka Sari	Not recorded by the author (Not known?)	216 ha	Not recorded by the author	Small-scale centralized sewerage system covering 34 ha and around 500 households (1993)	A field visit in January 2011 and some interviews with (public) officials

Source: Author's composition based on: a) information during author's field visit(s); b) Yudiarso (2010); c) The Jakarta Post 13 May 2013; d) the website of municipality of North Jakarta

5.4. The Empirical Methods

In analysing the governance dynamics within the Indonesian sanitation sector, both at the national level and within Jakarta's governmental tiers, the role of interviews is very important due to the lack of official documents that is available or can be accessed. The interviews were conducted also to reveal the possibilities of institutional reform to accommodate community-based sanitation development models.

The empirical research began by addressing the question why there has been so little investment made by the government for wastewater management. Addressing this question, the governmental dynamics between the national bodies and provincial agencies of DKI Jakarta, in addition to the relation between the province and the six municipalities of Jakarta, became a main focus in this stage of empirical research. **Figure 8** shows agencies with (potential) mandates for sanitation development in the Indonesian context i.e. Jakarta. The chart is based on: a) the 2009-14 national urban sanitation development programme called PPSP, b) the regional law (PERDA No. 10/ 2008) about official tasks and mandates of local government agencies in DKI Jakarta. Several interviews were conducted from August 2010 to October 2012, involving the national, provincial and municipal agencies (*shaded grey* in Figure 8). The interviewees held positions that range from government technical staff to high level civil servants (echelon 3 and 2). The list of interviewees grew like a rolling snow-ball (see also Appendix 4 for the list of interviewees).[14]

In line with the analytical framework which stresses the diversity of agency in the sanitation sector – especially in kampungs - the role of non-governmental organizations is also examined within the period of research, to understand their involvements in community and/or environmental sanitation development. These actors are also listed in Figure 8. There are, indeed, other relevant actors that have not been included in Figure 8. However, the dynamics of the agencies in the scheme offer sufficient material for a concrete discussion on finding ways for more efficient and effective urban governance to provide water and sanitation services for all needs.

Within the period of May-December 2011, fieldwork was conducted in Kampung Kojan and 16 beneficiaries of the program, their household members (including the tenants of benefited landlords) as well as some local leaders were interviewed. Beyond the kampung level, several interviews have been conducted from August 2010 to October 2012, involving higher officers and field staff of Mercy Corps as well as those of the national, provincial and municipal agencies.

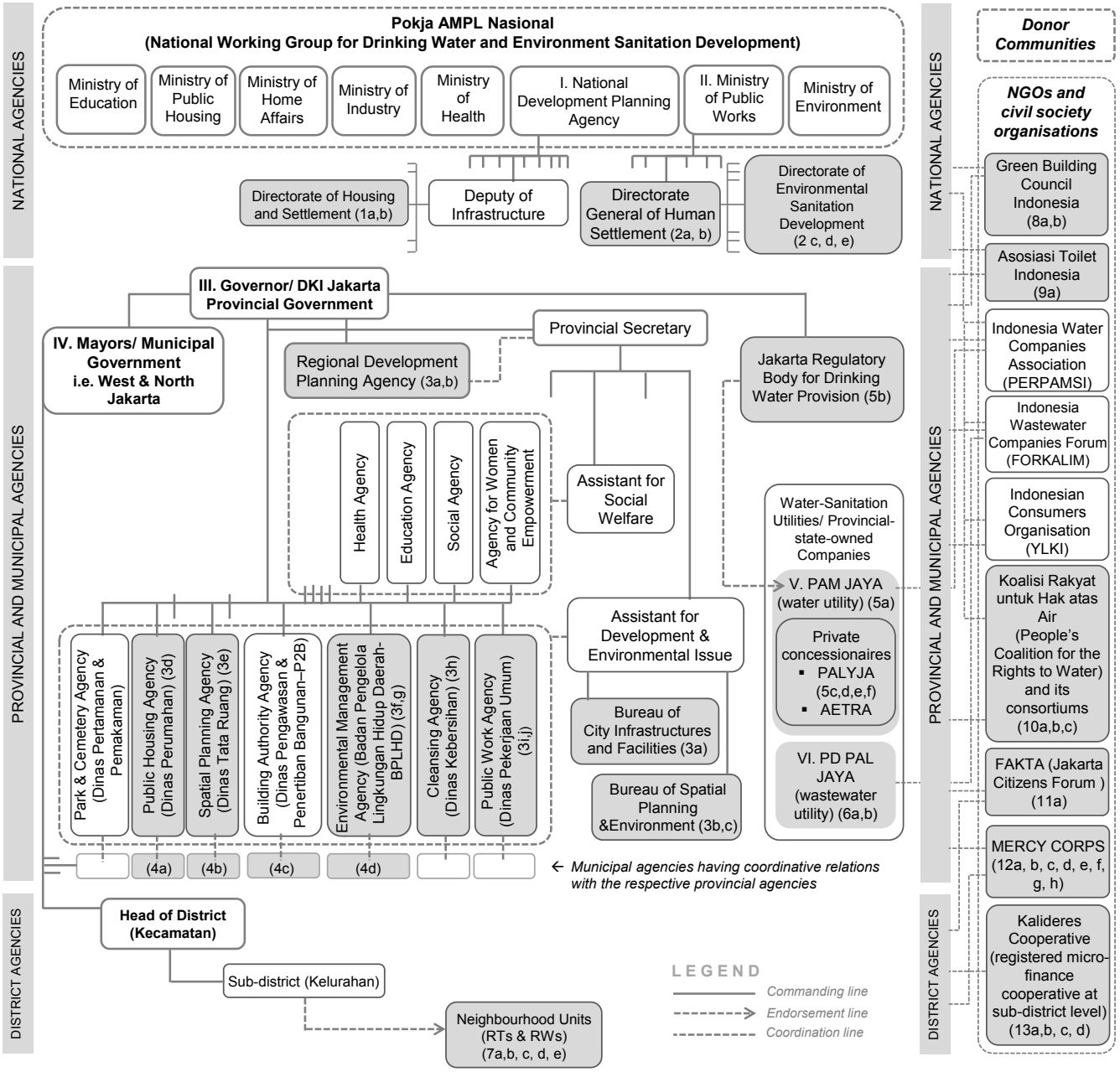

Figure 8. Indonesian Sanitation Governance, the Case of Jakarta, see also Appendix 4 for the list of interviewees

Shaded grey is agencies with interviewed individuals

Source: *the author*

The field work in Kampung Kojan was conducted with the help of Setiaji Wibowo, my research assistant who studied political science at the University of Indonesia. We agreed that he also used the case of Kampung for his undergraduate thesis.

Beside the contemporary study of kampungs, a historical study about the transformations of urban kampungs in Batavia – the colonial Jakarta – and post-independence Jakarta has been conducted as part of this PhD research. The historical trajectories of sanitation and spatial development were traced through interviews with senior government officials, historical maps, old photographs and some planning documents, as well as literature studies. For this thesis, I provided some collages of (historical) maps, combining cartographic information from several maps and merged it into new figures to provide necessary information for the study. Because the collected maps are in the form of pixel-based graphics, the collations were done manually with the help of some graphic software. Considering that the maps were not made on the same baselines and scale, the collages only show approximate spatial distributions of kampungs in Jakarta (mainly presented in the second paper).

NOTES

1. The Disaster *Mitigation* Agency of DKI Jakarta, http://bpbd.jakarta.go.id
2. *The Jakarta Globe*, 21 January 2014
3. *The Jakarta Post* 14 May and 30 September 2013
4. *The Jakarta Post* 22 June, 16 and 20 August 2013
5. *The Jakarta Post* 13, 14, 22 May, 24 and 26 August, 13 December 2013
6. Grey water is domestic wastewater produced from washing activities
7. Black water is domestic wastewater containing faecal waste and urine
8. Based on the author's professional contribution in Jakarta during August 2009 for Oxford Policy Management (OPM). OPM conducted a global study on the Political Economy of Sanitation for the World Bank/ Water and Sanitation Program.
9. In central and eastern Java the kingdoms started to occupy delta regions only in the ninth century (Christie 1991). It was earlier in western Java; an archaeological finding around Jakarta indicates the presence of irrigated canals that were probably organized by the Tarumanagara Kingdom in the fifth century (see Blackburn 2011). Community coastal settlements triggered by trades actually had emerged since the second century. See Christie (1991), Ford (1993), and Widodo (2009).
10. a municipality official, author's interview, January 2012
11. author's interview with various government officials
12. Based on a methodology paper that was presented in the Young AESOP PhD Workshop in Turku, 3-5 July 2010 as well as a paper that was presented in the World Planning School Congress in Perth, 4-8 July 2011
13. *The Jakarta Post* 13, 14 May 2013
14. The first group of interviewees was selected based on the author's professional experience with Oxford Policy Management in researching the Political Economy of Sanitation in Indonesia during the period August-December 2009. These interviewees gave suggestions for further key informants, especially government officials.

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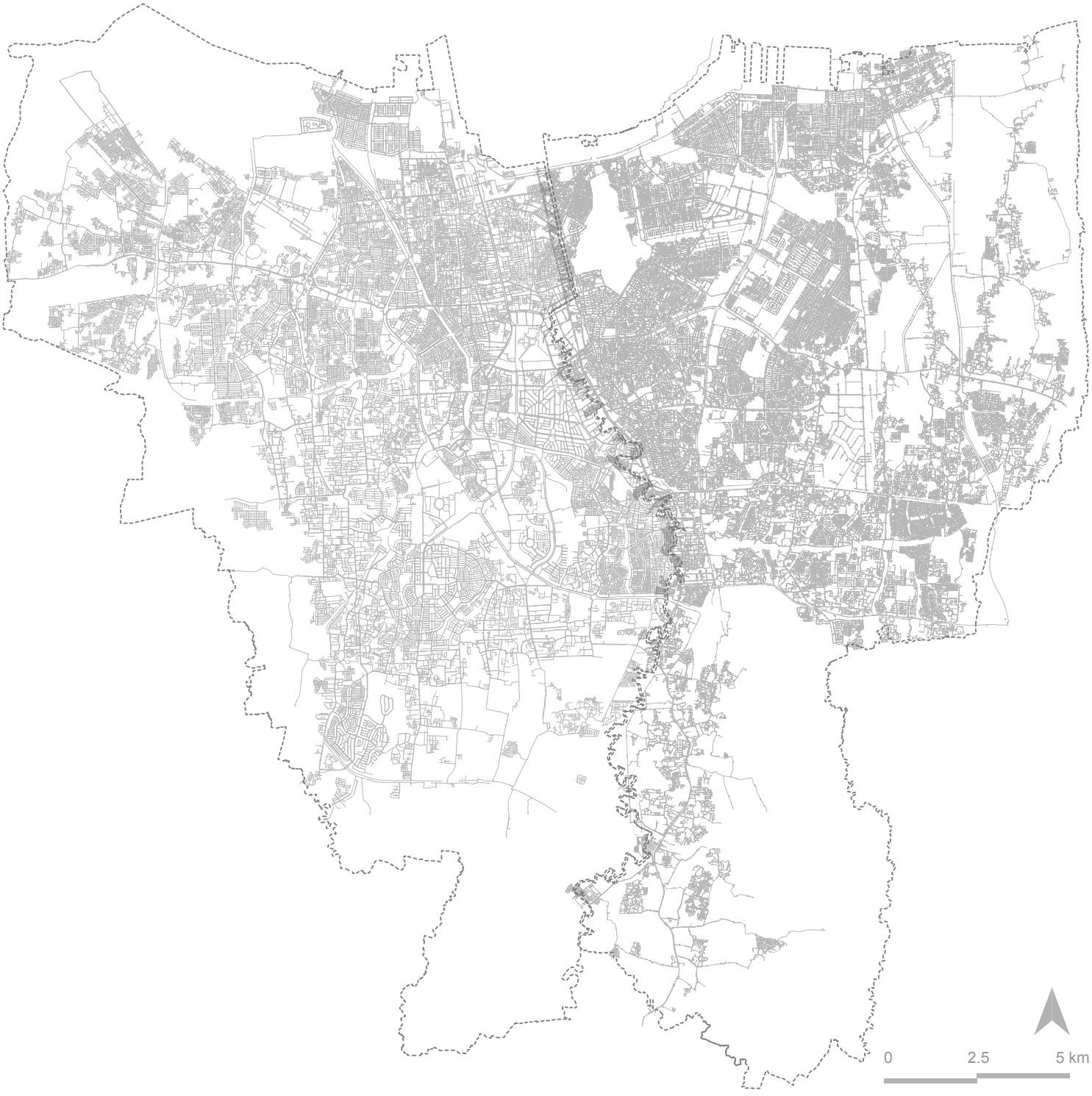
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< The spatial distribution of state waterlines in Jakarta
Source: courtesy of PAM Jaya, 2011

1.

INFORMAL SANITATION SERVICES IN SOUTHERN METROPOLISES

THE CASE OF JAKARTA *

Prathiwi W. Putri, Frank Moulaert and Teti A. Argo

Abstract

This paper examines the diversity of practices and forms of institutionalization in the water and water sanitation sector in Jakarta, capital of Indonesia, and especially in Kampung Kojan in the Kalideres Subdistrict. To this purpose it develops a three layered analytical framework which views the city as a metabolic socio-ecological system in which human-water relations and water sanitation services play a very important part. These services are highly diverse and have emerged from the articulation of the modes of socio-economic organization that have characterized subsequent stages of Batavia's development trajectory.

Particular attention is given to informality in water and sanitation service provision and how it interacts with 'regular' state and corporate market sector initiatives. Informality is not only a survival strategy but also a source of creativity in connecting ecological opportunities, technologies – both traditional and contemporary - and modes of self-regulation to each other.

The paper analyses on-going institutionalization processes in the formal and informal economy as well as across them. It reflects on opportunities to integrate and regularize the diverse production-scape of water sanitation service provisions into community-managed closed water-wastewater cycles. Within these cycles, relatively autonomous environmental sanitation systems would be able to ensure public health and sustain bio-hydrological balance at the local level.

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The main author wrote 80 % of the text.

1. INTRODUCTION

In many cities of the Global South, the majority of residents rely on the informal sector for income and housing but equally so for their water and sanitation services (Hardoy et al., 2005; Kooy & Bakker, 2008; Solo, 1999; Wilson et al., 2006). For many communities, informal water and sanitation services constitute a necessary alternative to the 'formal' services offered by the state and the private market sector, because the latter have failed to match the rapid urban population growth, and to serve the sanitation needs of the people with the lowest income and those who live in peri-urban areas (Aguilar & De Fuentes, 2007; Bakker, 2007; Bakker et al., 2008; Hardoy et al., 2005).

This paper works with a triple layered analytical framework to study diverse water and sanitation services in cities of the Global South and applies it to Jakarta, the capital of Indonesia. Two main expectations dominate the design of this framework.

First, it should explain the (re)production of articulated spatial scales and overlapping territories embedding the connections between different forms of informality in poor settlements of Southern Metropolises. It should clarify how informal practices and processes are impregnated not only by local dynamics but also by the transformation of the wider, multiscalar socio-economic system (Castells & Portes, 1989; Kesteloot & Meert, 1999; Mingione, 1991).

Although the concept of 'informality' as a mode of economic production and allocation has been widely accepted in the analysis of urbanization processes in the Global South, its origins have been theorized in different ways (for reviews see Kesteloot & Meert, 1999; Roy, 2005, 2010). Contemporary applications enhance the critical perspective (e.g. Mingione, 1991) that sees urban informality as practices of valuation and negotiation, as part of a broader metabolism involving formal and informal socio-economic and socio-political processes (McFarlane, 2012). The world of water and sanitation services in Southern metropolises fits this picture of osmotic conceptualization of informality quite well (see also Kooy, 2014; McFarlane, 2012). Studying the fluid urban water sector and its agencies requires identifying its main agents, formal as well as informal, their typical strategies and the socio-territorial processes in which they partake. Thus, this paper argues, the study of

informal water and sanitation services should also recognize the role of oligopolistic, often global market players that have directly and indirectly spurred the expansion and densification of informal settlements in urban areas. Also the state plays a significant role in these spatial development dynamics, as it has catalysed many practices of informal urbanization. Although far from omnipotent and overly obedient to global corporate players, the state has the authority to define what is 'formal' or 'informal', in addition to 'legal' and 'illegal', and many state institutions accommodate a diversity of actors adopting informal practices (see McFarlane, 2012; Miraftab, 2005; Roy, 2010; Yiftachel, 2009).

Second, the analytical framework should embrace the water and sanitation problematic in an integrated way. The socio-economic and socio-political metabolism metaphor referred to in the first analytical concern should be broadened to include the whole multifaceted bio-physical cycle of water: storm water, clean water, wastewater, geological and hydrographical conditions, etc. Yet the modernist logic adopts a functionalist conception of the water system and breaks the loop of water into sections, thus separating 'clean water' from other water forms. The main reason for this is that clean water is more easily commodifiable. Furthermore, water is not only a domestic consumption product, a proxy of H_2O, but must also be seen as a vital link in the socio-cultural-ecological cycle meant to sustain household (re)productive systems and community agriculture networks (see Lansing, 1987; Lansing & de Vet, 2012).

Within the modernist logic, shortfalls in water and sanitation service provision should be overcome by strengthening its supply side through governmental cooperation and increasing the city-wide networking capacity, and by encouraging broader private sector involvement to fill lacunae in public service caused by low state capability (see Bakker, 2003; Braadbaart, 2005). However, this logic presents the actual role of the private sector in an overly rosy way; it does not recognize uneven opportunities to access 'formal' service provision and different levels of community vulnerability to the fast deteriorating urban environment; nor does it discern the holistic character of the metabolic processes which refers to the diversity of water-based needs and practices and their intrinsic interconnection.

Combining these analytical concerns has significant consequences for the way the roles, agencies and the institutionalization of different water services relationships should be addressed. Considering that the state and the corporate market sector alone cannot meet or not even properly identify the needs of the urban poor in the Global South (Bakker et al., 2008; Loftus, 2009; Ostrom, 1996), much needed institutional reforms should also involve informal actors in pursuing solutions to water related problems. The badly needed 'new' agencies should take into account the bio-physical material conditions under which environmental sanitation systems can 'naturally' perform, including water supply, drainage, solid waste and wastewater

management. For overlooking 'ecology' means failing to view water as a finite resource over which urban actors compete and whose provision should be warranted for all population groups (Barlow, 2001; Loftus, 2009). New practices and agencies should therefore themselves be situated within the contradictions of the water cycle with its conflicting yet potentially compatible uses of water, its multiplicity of service providers and multi-scalar territorialities.

Therefore, the analytical framework of this paper addresses the water sanitation problems not merely as technical problems to collect and treat domestic wastewater through functionalist and global market led strategies, but as the needs of diverse communities in search of healthy living conditions for which the protection of (traditional) water sources is essential. Meeting these needs would require collective environmental management systems in which the local communities play a decisive role (e.g. the kampungs). Thus, the future water and sanitation service system should not only rely on the institutionalization of state and corporate sector infrastructures and practices, but also on the regularization of robust informal service practices.

To meet these analytical concerns, the analytical framework guiding this paper disentangles the formal and informal complexities of the urban sanitation sector and its multi-scalar and overlapping territorialities according to three interrelated layers of explanation. ***The first layer*** unravels the production of contemporary waterscapes in cities of the Global South, as a multi-stage historical transformation resulting from the interaction between formal and informal actors in different socio-ecological spaces. ***The second layer*** explains the informalization dynamics of water and sanitation development *at the neighbourhood level*. In many cases, these dynamics can be attributed to uneven economic development resulting from several (on-going) economic restructuring processes and asymmetric institutionalization processes that involve (global) firms, state agencies as well as enterprises from the informal sector. ***The third layer*** analyses the reproduction of uneven development through different institutionalization processes: the formal state-led and corporate sector driven spatial planning system, the real estate driven middle class urban settlement development procedures and the informal practices in the kampungs that are reproduced in the grey area between regularization and informal institutionalization. The role of NGOs as particular institutional enablers will be a special focus in the analysis of the institutionalization process.

This analytical framework will lead the study of the diversity of water and sanitation service practices and their institutionalization in Jakarta and one of its urban kampungs in *Kalideres Subdistrict*, i.e., *Kampung Kojan*. In the colonial time, the indigenous word 'kampung' was used to label non-European and non-Chinese settlements. Today an urban kampung is a typical spatial enclave in Indonesian cities in which informality takes on different forms.

The main author conducted fieldwork in *Kampung Kojan* between May and December 2011, by way of participatory observation and interviewing household representatives and owners of rental rooms for workers who have benefited from a sanitation development project delivered by Mercy Corps, an international NGO. Key officers of the NGO and some local leaders were also interviewed. In the last two years, with the help of a research assistant, updates of this empirical research were made. To analyse the dynamics beyond the Kampung, several government officials were interviewed between August 2010 and October 2012. Data from the interviews are acknowledged in footnotes.

Five sections follow this introduction. The first explains the three layers of the analytical framework. For the analysis of Jakarta and *Kampung Kojan*, each of the layers is applied (sections 3 through 5). The last section wraps up the analysis and volunteers some prospects for integrated institutionalization of the water and water sanitation service sector.

2. A THREE-LAYERED ANALYTICAL FRAMEWORK

The three layered analytical framework was developed to meet the analytical concerns expressed in the introduction. This section explains the connections between the analytical concerns and the way the three-layered framework addresses them.

The binding principle on which the analytical framework rests is that water is a natural element and also a product of complex social dynamics. Securing water for urban populations is part of a greater (conflictive) socio-ecological process inside and outside the city (see Swyngedouw, 2004b). The city itself consists of different socio-physical environments that are 'actively and historically produced' by multiple actors (agents) with different capabilities to influence the urban metabolism processes (Swyngedouw et al., 2002) as well as institutionalize practices and modes of behaviour (Moulaert and Lambooy 1995). In these different settings of urban environment, actors use water and other natural resources in diverse ways. Their positions within socio-economic structures influence their relationship with nature. In turn, their relations with nature (re)establish their socio-economic positions.

Layer 1 of the analysis is built on the philosophical premise that people and communities in the city use water within a contested and fragmented urban space. Appropriation and uses of this space are determined by human-human and human-nature relations in which informal practices are ubiquitous. As a premise to the two other analytical layers, layer 1 unfolds dual complexities in the water and sanitation sector as the expression of relationships between human and non-human actors. The contested urban space is the outcome

of inter-temporal articulations of social-economic-political-ecological configurations in the city, as manifested in certain spatial patterns.

This layer is important to critically assess the modernity approach that has partly shaped the configuration of both the colonial and post-colonial city. When interpreted and applied linearly, modernization standardizes the way in which space is imagined and stands for a single trajectory of 'becoming' that is isolated from other processes, discursively narrates a single scalar configuration (only between a local place or our daily habitat, and other spatial objects or forms out there) and enforces certain ways of organizing space including the social relations that constitute that space (see Massey, 2005, pp. 61-103). Space in the modernist imagination is divided into bounded places that are seen as temporally sequential, with each place representing a stage of a single trajectory (Ibid., 2005, pp. 66-7).

Accordingly, the modernist vision considers the problems of the water and sanitation sector in the Global South as linked to a development stage that is still far behind that of advanced industrialized countries in the North. Continuously repeated and amplified by international organizations, consultancies and other corporate enterprises, this misunderstanding leads policy makers in Southern countries to transplanting the urban ideals of advanced industrialized countries, and make them believe that the transfer of their institutional and technological models, to the Global South will drive development forward (see Bakker, 2003; Gandy, 2008). Such transfer reserves a lead role to corporate market players in building the water and water sanitation service infrastructures. However, Northern water infrastructure models are in general not suitable for urban societies in the South as their development trajectories are highly different. Both state and market but also civil society, have different roles in Southern countries, not the least because they are embedded in their own history and geography. For example, in many cases, the state is not able to secure long-term capital investments needed for large-scale infrastructure developments and, at the same time, to consolidate the market for standardized service provision, or provide subsidies to have all inhabitants connected to the networks (Araral et al., 2011; Bakker, 2003; Ostrom, 1996; Whittington et al., 2012). A main reason for this is that its relations with market and civil society actors, in overlapping yet conflictive urban sub-territories, embodies a history of complex connections between formal and informal, modern and premodern practices and processes.

It is remarkable how the neo-modernist post-colonial state categorizes 'informal water and sanitation services' and refers to them as operating outside the territories served by large-scale piped water infrastructures and/or provided by the actors other than the state and big corporations (see Kooy, 2014). Yet local communities had already organized access

to water and sanitation individually or collectively by employing a diversity of means, long before the modern state and industry proclaimed the ambition of providing 'universal' water and sanitation services by institutionalizing certain technological systems. Fortunately, in many urban areas in the Global South, these community practices persist, yet coexisting in complex interaction with the state-organized services (Crawford & Bell, 2012; Gopakumar, 2014). This disproves the assumption that the two spheres of formal-informal water services are not connected and that each of them has been growing in its closed socio-political system (Kooy, 2014; McFarlane, 2012). It shows that the actors of formal and informal institutions might and often do create overlapping territories, in which their strategies for water and sanitation service provisions are contested, but could also produce complementarity (see Gopakumar, 2014).

The ***Second layer*** highlights the characteristics of the informal sector and emphasizes internal differentiation within this sector. It provides the production-scape concept with a grounded diversity content, stressing the osmosis between the formal and informal economy as well as between productive and reproductive spheres. It explains the concrete meaning of the interaction between informality and formality for water and water sanitation services, seeking to understand the interplays that determine household strategies in meeting basic environmental sanitation needs.

Enzo Mingione (1991) laid a comprehensive analytical foundation for understanding 'informality' and places it within the interactive dynamics of different sectors in economy and society as a whole. Commencing with a theoretical discussion of the broad concept of *work*, he argues that in fulfilling the needs of material survival, humans (within a 'household', the smallest collective entity in social relations) must combine several types of work: formal employment with monetary income, non-monetary income through self-subsistence, monetary income that is considered illegal, and non-monetary income provided by public institutions, e.g. in-kind subsidies (Mingione, 1991, pp. 80-82). The range of work-type combinations depends on their socio-economic background and (industrial) transformation processes in which they developed (Mingione, 1991).

Industrialization, as one strong factor determining societal transformations today, requires a broad range of associative regulatory processes. 'Wide ranging regulations of an associative kind have to be considered an essential part of industrial development and are prompted by the very diffusion of competitive market tensions' (Mingione, 1991, p. 114). Apart from 'regulatory', 'informalization' processes are also active within industrial transformation processes. 'Informalization' processes materialize through the diffusion of informal activities, such as reciprocal arrangements that respond to competitive tensions created by the industrialization processes. Thus informalization practices are not only survival strategies for

families and communities but also constitute a strategy promoted or even applied by global agents pursuing neoliberal agendas at the local level (Roy, 2005; Swyngedouw, 1997, 2004a).

Whence Mingione avoids putting the formal and informal economy into binary opposition, and does not name 'regulatory processes' as 'formalization'; he argues that 'regulatory processes' are connected and developed along the same lines as 'informalization' (Mingione, 1991, p 85). Regulatory and informalization processes form part of 'a cycle of successive adjustments' pushed by interest groups, mainly to reduce or effectively remove obstacles (cf. Ibid., 1991, p. 116-7). Thus, 'informality' is not a static condition, and the distinction between formal and informal is possible only when and where the economy is subjected to a relatively high degree of regulation by the state, corporations and the associative institutional regulatory system (Mingione, 1991, p. 84-6, 108, 118).

The strict division of work types generated by the modern industrialization process has 'brought about a variable and changing degree of separation of productive human behaviour from an originally unified productive-reproductive collective organization based on reciprocity' (Mingione, 1991, p. 190). The informal economy, in contrast, maintains the interwoven nature of productive and reproductive activities; thus the informal economy is growing to fulfil the needs that remain unmet by the formal market economy. Industrial restructuring (the further separation between ownership and operating management, between automated and manual tasks, …) and the tertiarization processes (e.g. innovations in financial markets, the growing services sector, etc.) have driven a greater and increasing diversification of work and pay scales within the market economy (see Harvey, 2005; Mingione, 1991). Thus the coexistence of exploitative capitalism and widespread informal economy are interactive parts of the larger economic system in many cities of the Global South. Although informal work cannot always be associated with poverty (Castells & Portes, 1989), the vast majority of informal workers are low-paid (see Cuevas et al., 2009). In fact, many formally employed workers also receive low wages besides being employed with temporary contracts, notably those in wholesale and retail trade, the biggest component of the service sector (Ibid., 2009).

Unreliable (formal) incomes have been a main factor of growing informal economy networks. Specialized community services emerge in parallel with the rapid population growth to provide inhabitants of the kampungs with cheap services such as catering, laundry and cleaning services. At the same time many of these services contribute to ease the burden of domestic work of middle and high income classes while being an additional (informal) source of income for low income groups.

Informal provision includes water and sanitation services that emerge either outside or in interaction with the state/ market provision systems. There is a diffused and variable

form of reciprocity in this service relation that does not fit with the economic regularization processes, but sustains various modes of community water and sanitation service provision. The community services are predominantly accessed through (informal) redistribution and non-monetary exchange like solidarity and self-help networks, as discussed by, among others, Kesteloot & Meert (1999) and Mingione (1991, p. 185-190). However, such solutions for meeting day-to-day needs are exposed to external pressures (see Simone, 2012). It can be argued that such pressures stem from ambiguous market regularization ambitions and ambivalent state performance.

Layer 3 of the analytical framework addresses the (re)production of urban inequalities through different modes of institutionalization of collective spatial practices and how they reinforce each other. Three main modes of institutionalization are in the spotlight: state spatial planning in the modernist tradition that exists in advanced symbiosis by the corporate market sector; real estate led spatial organization of privileged neighbourhoods; and poor settlement or kampung spatial organization seeking for institutionalization through endured reciprocity but also through associative regulatory processes in cooperation with state, market and external civil society organizations (especially NGOs). These three main modes of institutionalization and how they (will) interact will affect the future development of the water and sanitation services in the urban territories of Jakarta.

Fragmented urban spatial patterns and the disparities in basic sanitation services and their geographical distribution are the consequences of uneven socio-economic development, and are continuously (re)produced by various institutional dynamics involving diverse agents with diverse ambitions. Such spatial fragmentation is reinforced by state infrastructure development that basically follows the geographical ambitions of the global market economy and gives a low priority to poor neighbourhoods (Allen et al., 2006; Mollenkopf, 1983).

The diverse institutionalization of water sanitation services can best be explained by returning once again to the neoliberal discourse which argues that private firms deliver services more efficiently than state-owned enterprises (Bakker, 2003; Braadbaart, 2005). But these firms pursue high profits and only serve ‘premium networked spaces’ to the disadvantage of other areas (Graham, 2000, 2002). In addition premium spaces play an important role in building a new image, usually of city centres, to increase the competitiveness of the city and its attractiveness to ‘spatially mobile investors’ (Rogerson et al., 1996). It can be argued that massive investment in water and water sanitation infrastructure, supported by spatial planning practices, is just a new arena of capital accumulation. Basic infrastructures that were once regulated by the state within the reproductive sphere are now turned over to the private sector and deregulated (Harvey, 2005). Thus, for some large companies, the water

and sanitation sector in large Southern cities has become part of the productive sphere of capital accumulation. Yet they as well as state and community actors operating in the water sanitation production-scape have to serve spatially and socially fragmented markets, whose institutionalization is based on continuous negotiation of multiple forms of regularization and informalization between a diversity of actors.

3. CONTESTED URBAN TERRITORIALITIES IN JAKARTA

The perspective adapted by the first analytical layer metaphorizes the formation of the city as a metabolic and institutionalized composition of fragmented yet intertwined territories of water and water sanitation services consumption and production practices. Contrary to the modernist belief, these practices are highly diverse and many of them have emerged from the inter-temporal and spatial articulation of modes of socio-economic development. A brief recapitulation of Jakarta's space-time development trajectory is necessary to ground the analysis of existent and emergent water sanitation practices as well as identifying institutional opportunities to better integrate and institutionalize them to the benefit of the city as a whole.

In the 17th Century, the Dutch built Batavia (named Jakarta after independence) over the ruins of *Jayakarta*, a port settlement of the Banten Sultanate. Batavia grew together with many kampungs in its vicinity, some of which had existed prior to the colonial city. While the colonial port city was dominated by the Europeans and Chinese, kampungs in the southern areas were mainly occupied by indigenous communities (Blackburn, 2011) with a traditional economy based on subsistence agriculture and commerce.

The nineteenth century development of the inland colonial town involved evictions of many communities towards surrounding kampungs that gradually became crowded, thus forcing communities to abandon their subsistence agriculture system because of land shortages (see Elson, 1986). The changing relationship between communities and their lands in interaction with many other socio-ecological transformations in Batavia reproduced Jakarta's contemporary urban metabolic system. From an infrastructural perspective, **Figure 1** shows the crossing – often overlapping and conflicting – networks of rivers, canals, water pipes and roads that are sustaining different, yet interdependent, sets of socio-ecological relations in Jakarta.

For most of kampung communities in the colonial period, the thirteen rivers flowing across the low lands were crucial resources for living, cultivating and breeding as well as

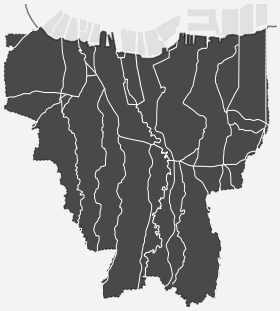
transportation (Blackburn, 2011; Boomgaard, 2007). Until the beginning of the colonial era, household and small-scale community-based environmental management systems used to perform well and were well integrated with subsistence agriculture activities. Crop lands and fish ponds were structured by organic features of river basins that allow water to flow slowly and being recharged into the ground.

The rivers also played an important role for the Dutch rulers. The colonial port town was built by engineering land and water. Rivers were turned into canals, straightened with concrete walls, as icons of modernity and progress (see also Ravesteijn & Kop, 2008). When roads began to replace canals for transportation in the inland colonial town, river-engineering was still one of the main tasks of the national public work agency whose responsibility it was to maintain or even speed up the water flow of the streams carrying silts and wastewater, to keep the land free from inundations and the populations from diseases (Kop, 2008).

Today, the thirteen rivers of Jakarta function as open sewers. PDPAL Jaya, the wastewater company of Jakarta Province, estimates that almost 3,000 cubic metres of faeces are produced by nine million people of Jakarta every day (PDPAL Jaya, 2010). The centralized sewerage system began to operate in 1983 and it covers only two per cent of the area while there are only around one and a half million septic tanks that often are leaking, polluting the ground and water bodies (Miller, 2006; PDPAL Jaya, 2010). Poor quality septic tanks are mainly located in the kampungs. The municipality and licensed private enterprises operate around 105 trucks to empty these septic tanks and haul the sludge to two dedicated treatment plants. There is frequent illegal discharge of sludge into nearby open water bodies because many, including informally sub-contracted and non-registered, operators prefer to reduce transportation costs by avoiding the far away septage treatment plants[1,2] (see also Moersid, 1998).

The polluted rivers today not only bring calamities to poor communities, but also exacerbate the problems to obtain raw water for the two piped water companies in Jakarta. Production costs for clean water provisions keep increasing, leading to higher water tariffs.[3] In fact, getting water resources for urban population in the low lands of Jakarta has been a struggle since the colonial time. In 1873, water provision was organized collectively for the first time; the state constructed artesian hydrants that were individually connected to European houses through local pipe networks (Kooy, 2008). Having insufficient supply of healthy drinking water by itself, the twentieth century Batavia was equipped with 50 kilometres of iron pipes transporting spring water from the southern mountains to still the thirst of its wealthy families.

Figure 1. The socio-ecological networks of Jakarta
Source: redrawn by the main author based on several maps owned by PAM Jaya, the provincial-state water company; and maps from Jakarta Master Plan 2030



The 13 Rivers of Jakarta

1. Jakarta
2. Planned sea-reclamation sites
3. Jatiluhur Dam

Main intercity roads

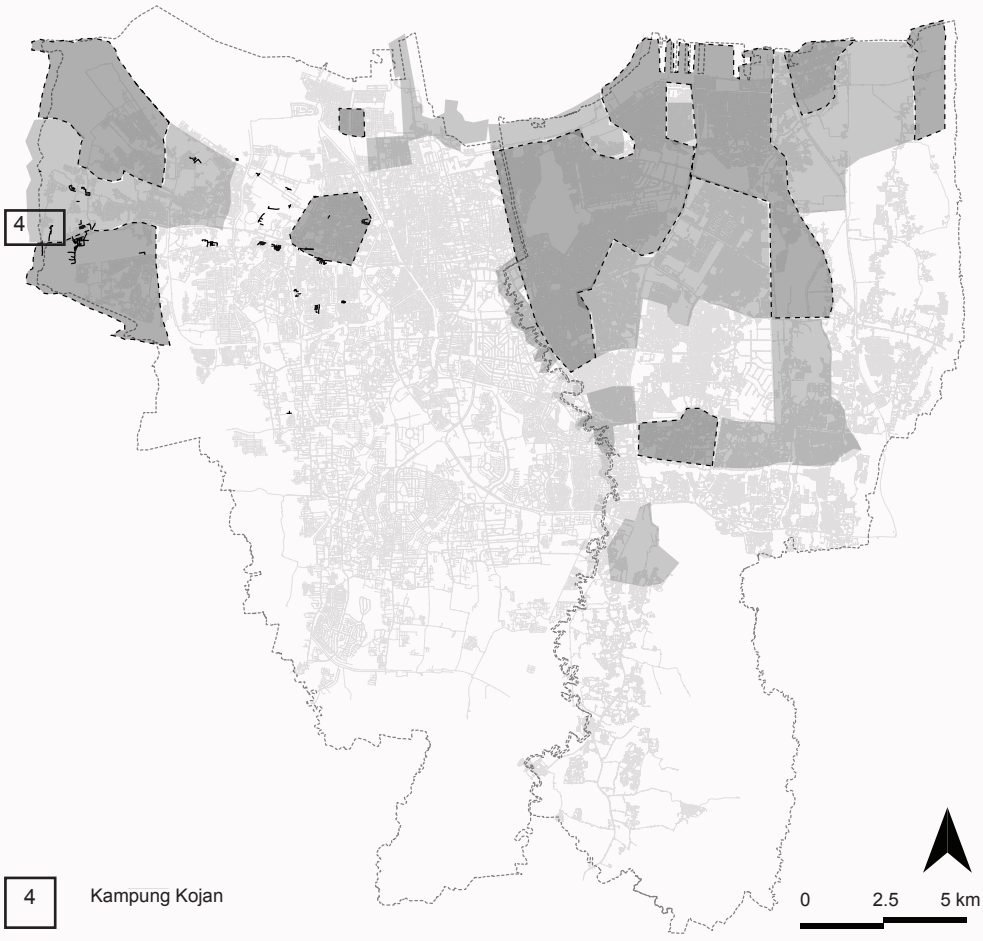
Rivers

Raw-water canals for clean water supply

Mountains

Serpong Water Treatment Plant producing supply for Jakarta, in addition to the WTPs located in Jakarta

B. JAKARTA



Areas with no water pressure

Areas with low water pressure

Piped-waterlines

Previous illegal connections that have been regulated

After independence, the water provision system has further modernized with the construction of seven water treatment plants to which nearly 18,000 litres of surface water is channelled every second to be purified. As much as 80 per cent of this volume comes from the Jatiluhur Dam, transported through the 70 kilometres West Tarum Canal by means of seventeen hydraulic pumps (IndII, 2010). But the political and technological efforts to pump and treat water, distributing water to consumers could not meet the challenge of bringing water to consumers city-wide. Currently, the piped water networks covers around 62 per cent of the Jakarta area (see Figure 1), but only around 800,000 households are listed as subscribers of the state water company.[4]

Outside of what is called the archipelagos of state piped water networks (Bakker, 2003; Gopakumar, 2014), developers or real-estate operators organize smaller-scale networks to exclusively serve those who can afford to live in the housing estates. Both piped-water provision systems face the problems of intermittent supply; as a consequence their subscriber households still have to rely on other water sources. Moreover, since the piped-water is not potable, most of them also consume bottled drinking water that is produced outside the city and transported over long and often congested road networks. Although some kampungs are connected to the state-built water pipelines, in many others, most of the population fully relies on non-piped-water sources: the rivers, individual shallow wells, and (mobile) vendors who fetch water from various sources. But these rivers are also the open urban gutters and the wells are increasingly affected by the contamination of the soil due to uncontrolled release of waste-water. The water cycle, although socially, technically and institutionally fragmented, forms indeed a unity and occurs in great need of restoring the balance between the quality requirements for its different uses.

3.1. Permeability of the Socio-Infrastructural Networks

The above analysis shows how the interwoven meshes of networks are socio-ecologically embedded and constitute Jakarta's water and sanitation infrastructure. There is no single provision system that is operating in isolation. Each of the existing water and sanitation service systems has a certain level of permeability. For example, an official pipe network is illegally connected to many (informal) settlements and non-revenue water 'leaks' to benefit not only the poor households but also corrupt bureaucrats. In the reverse direction, pollutants contaminate the water supply due to breakages in the old or technically failing pipe network; and untreated wastewater cannot be kept from penetrating the open canals that convey raw water to treatment plants. Besides the bio-physical permeability, a variety of institutional

logics diffuse across different water infrastructure systems. A complex web of institutions and actors, embedded in intertwining socio-economic settings (see Moulaert & Jessop, 2013), sustains different social relations of exchange involving many forms of the material H_2O – and sets the contours for future institutional synergies – see layer 3 below.

Given the permeability of the socio-infrastructural 'membranes' within interdependent socio-ecological systems, the analytical distinction between formal and informal water and sanitation service provision becomes problematic if it is based simply on piped versus non-piped or centralized versus decentralized infrastructures (see also Kooy, 2014). In Jakarta, this way of dual categorizing also flouts the fact that the popular use of non-piped networks such as individual household septic tanks or the widespread consumption of bottled drinking water has always been encouraged by legal regulations. It is interesting to observe that the policy discourse on Jakarta wastewater management is mainly rotating around the dualisms 'centralized-decentralized' and not 'formal-informal'.[5,6] Yet covering only two per cent area of the urban area, the 'centralized' sewerage system has not been the dominant infrastructure and could hardly be labelled the 'formal' provision system, as is the case for the piped water supply system.

The following section adopts the layer 2 perspective to analyse community practices in Kampung Kojan in Jakarta, to provide water and sanitation services within the informal economy, but in interaction with the formal economy. It is argued that the highly permeable membranes of the so called 'productive' and 'reproductive' spheres of the informal economy not only mould the modes of the community service production scape, but also the patterns of service consumption (see also Crawford & Bell, 2012).

4. INFORMALIZING SANITATION SERVICE PROVISION IN A KAMPUNG OF JAKARTA

Kampung Kojan in Kalideres Subdistrict is an urban kampung that is typical of Jakarta's periphery. It is surrounded by factories, warehouses, logistics providers and supply chain industries that began to grow in the late of 1980s, but also by gated housing estates. In this way it is representative of the socio-spatial fragmentation of Jakarta. The Betawi people who are acknowledged as the original ethnic group of Jakarta dominate its cultural-political constellation; most neighbourhood leaders and landowners are Betawi. The population of the Kampung includes at least four generations, and according to witness reports the Betawi community moved into the area after being evicted from other areas in Jakarta.[7]

Kampung Kojan is officially known as RW 6 (an administrative territory within a subdistrict). Around six thousand people or between 1500-1700 families live there.[8] Most household heads work in the factories and warehouses located nearby or as petty traders (SUEZ Environment & Mercy Corps, 2010). Other household members work in the informal economy in different service activities. Formal employment (blue collar workers and low-level employees) accounts for only around 16 per cent of the population (projected from the demographic data of Kalideres Subdistric, 2011). Partly in parallel with the increasing frequency of circular migrations the level of informal employment is high (cf. Mulyana, 2012). Life in Kampung Kojan witnesses of everyday urbanism in Jakarta with its variety of informal economic practices. These also stem from the way the formal economy relies on informal employment to keep its cost structure low.

Some 41 per cent of the households in Kampung Kojan rent a house or room (Ibid., 2010). Many Betawi people have constructed rental rooms on their land that once was used for agriculture, to respond to a high need of cheap housing for the workers. The number of rental rooms built by and managed under the same owner or operator varies, but most belong to small-scale estates. Perhaps this is because the former agricultural lands have been divided among family members or sold parcel-wise to migrants.[9]

Built on relatively small plots of land, not all housing provides latrines and bathrooms for its tenants. If available, these facilities are used collectively between tenants and sometimes shared also with the owners. Meeting the high demand for sanitation facilities, four public latrines in Kampung Kojan have been operating. Three of them are privately-owned and one was funded by Mercy Corps in 2009 but communally managed. One public latrine has been in use for more than 20 years and is in a poor condition. There has been no further significant investment to maintain the facility after its construction in the 1990s. Built and managed by a local entrepreneur on rented land, the latrine was sold to the landowner around mid-2013 due to decreasing profit and growing mismanagement.[10] It is no longer operated under strict supervision and many customers no longer pay for the services, as is also the case for another public latrine in the Kampung. Owing to the decreasing profitability, the owner of the latter wishes to demolish the latrine units and replace them with some rental rooms to gain more income.[11]

Evidently, different income structures have led to different levels of investment by landlords and tenants in water and sanitation infrastructures. Owners are not motivated to invest their time and resources in the improvement of water and sanitation facilities. Because many members of low income groups frequently have to change jobs and home, many landlords in the Kampung are reluctant to upgrade the sleeping shelters, not to mention spending resources on improving water and sanitation facilities, even for themselves.

In general, the inhabitants living in both individually owned houses and rental rooms have limited access to piped-water or proper sewage collection services. The condition would not be better as Kampung Kojan will be excluded from the future sewerage expansion projects. Water and sewerage companies tend to prioritize communities with stable purchasing power and land tenure status like those living in regular housing estates. That does not mean that state led initiatives are completely absent in the Kampung. Some initiatives have been taken to integrate the urban poor in the state initiated and market-led water and sanitation service provision systems. These initiatives basically address the perpetual problem of affordability of basic infrastructure necessary for such systems to work. In the interplay between neo-modernist state concepts of public service provision, profitable provision by the corporate market sector and affordability for the users, water provision rather than sanitation services comes out as a winner because its partnerships are easier to negotiate due to its natural commodifiability.

For example, in early 2008, one of the private water operators, PALYJA, launched a project as part of the Global Partnership on Output Based Aid (GPOBA) programme. Preceded by a socio-demographic research conducted by Mercy Corps, a partner in the GPOBA, this project built installations for household connections and expands water networks to some kampungs.[12] The GPOBA/PALYJA project has now connected 58 per cent of the households in Kampung Kojan to the piped-water network operated by PALYJA. It has also regularized those who had previously been 'illegally' channelling water from the network to their houses.[13] However, the lack of water pressure means that the GPOBA water subscribers suffer from intermittent supply, and often have to tap from shallow wells for their water provision. Topography plays a significant role in this; Jakarta is a coastal city located just above sea level, and as such has several areas with low or even no water pressure, including Kampung Kojan. The water company thus has difficulty delivering water to these places via the centralized system.

While clean water has been seen as a commodity by the corporate market providers, in contrast, the water sanitation sector is considered not profitable and has become less industrialized or even fully neglected. Yet in recent years the state approach towards urban wastewater management has changed. Whereas the responsibility of wastewater management had been left to individual households for many decades, causing urban environmental decay and increasing sanitation costs in general, the government has begun to speed up the pace of sanitation development. Incorporating so-called decentralized wastewater management systems has become a key element of the latest national policy of sanitation development in Indonesia (*Percepatan Pembangunan Sanitasi Permukiman*, the 2009 national acceleration programme

for urban sanitation development). Policy recommendations have been made in Jakarta, as well as at the national level, to regulate individual septic tanks before the government should engage with the expansion of the coverage area of the centralized sewerage network.[14, 15]

The strategy of decentralizing wastewater management can be seen as a way to accommodate the heterogeneity of environmental problems within the fragmented urban fabrics. Nevertheless, it entails many risks of burdening communities with responsibilities of environmental management in the absence of greater state involvement in that particular sector, especially the policy arena is dominated by the profit-maximizing behaviour of private (water) companies (see Miraftab, 2005). The industrialization of clean water provision has sharpened the bivalent production and consumption spheres of the water economy. From the perspective of the corporate sector, the specialized functions of treating water and distributing clean water necessitate a tariff that reflects the cost of production and distribution, plus a profit (see Ardhianie, 2011). The commercialized water is supposed to be consumed in the private sphere of the households. But the purchasing power that is left after having paid for the water does not allow them to pay for public or private environmental protection. Yet in the neo-modernist conception of sanitation infrastructure and its use, households are expected to keep their wastewater from polluting the urban ecological landscape and troubling the piped-water production by their own means. This ambiguous relationship between affordability and necessity pushes them even further into informality. But through the interaction between market pressure 'to buy' and search for self-provision, one of the basic pillars of the informal economy, i.e. reciprocity, seems to be undercut.

4.1. Asymmetric Permeability and Weakening Reciprocity

A neighbourhood with high population density definitely needs a collective water management system. Wells are drying, apart from also being polluted, and ground water recharge is beyond the capability of individual households and needs a collective endeavour. This kind of environmental pressure apparently has not been a strong stimulus for community members in Kampung Kojan to demand affordable, if not free, and reliable public water and sanitation services. Indeed, the household income structures impede 'voluntary' subscriptions to the expanded piped water networks or the selectively available sanitation infrastructure. Fundamentally, these inhabitants are not part of the imagined universal collective provision-consumption system in which the state grants equal rights to all citizens (Chatterjee, 2004), nor have they built a cohesive community driven water provision and sanitation infrastructure *cum* governance system (see Paper 4). Hence, many types of informal community water

and sanitation services keep growing as short-term survival tactics of individual households. These services are supported by overlapping reciprocity based networks involving households and communities. Kinship and friendship, among others, are fundamental social relations for households' survival strategies. Many inhabitants in the Kampung are still relatives from the Betawi people, allowing these families living in a close proximity to share water and sanitation facilities, as the following example illustrates. Suanah, a 30 year-old female, lives with Saroh, a widow, in a household of three generations with five bread-winners and three children. She explains:

> We are using a manual pump … we are also connected to the piped water of our relatives' house. In case the pump is not working, the water from the next house is channelled to this house…. If the [piped] water is not running, they come to us. [With the new latrine supported by Mercy Corps] we don't have to defecate in the canal anymore… sometimes other relatives stop by to use [the latrine]. [16]

Sharing facilities among neighbouring households is also common. This tradition of resource exchanges has now been adopted by the water company, but in its own way and to its own benefit; indeed the strategy to expand the piped water network in Kampung Kojan includes the utilization of shared meters. But sharing water meters, in fact, does not help the households to organize themselves to form associations of consumers in favour of better generally accessible water service provision. When facing an intermittent supply, households still rely on filthy water from the canal for laundry and cleaning. Kartini, a mother of three, whose husband and eldest child work as temporary labourers admit:

> We have been sharing the water meter with four other families for two years [since the PALYJA-GPOBA project]. … We now have our own latrine [thanks to the PUSH implementation] … but because the water is so low [the piped water supply is very limited], together with our neighbours, we wash [our clothes] in the canal.[17]

The wide-spreading informality dynamics in the water and sanitation sector is meaningful for capitalist social reproduction. Termed by Miraftab (2005) as 'informalizing social reproduction', diffuse reciprocity infiltrates the domain of public welfare services, supposed to maintain the productivity of workers in both formal and informal economic sectors. Such services should be provided or at least regulated by the state while in reality they are at the heart of the informal economy.

But the informalization of water and sanitation services does not necessarily lead to improved sanitary conditions in the kampungs, nor does it reinforce traditional reciprocities that are key to alternative collective provision modes. Informalizing water and sanitation services as is done in Jakarta's kampungs badly affects low income populations because they are positioned as self-responsible individual households without sufficient financial means. It forces them to spend their scarce resources on water and to apply ad hoc strategies to keep a minimum level of sanitation. Without a collective ability and infrastructure to recycle wastewater and protect their traditional water sources, this ambivalent situation will persist.

In Kampung Kojan, drinking water is prepared by boiling water or obtained by purchasing ready-to-drink water using refillable containers provided by small local vending stations that have emerged prominently in Jakarta since more than ten years (Weimer, 2006). Among 14 respondents[18], six families fully rely on this source of drinking water, two families use it in addition to boiling water from the state network, and three families drink it in addition to boiling water from wells and mobile vendors. Increasing amounts of pollutants in traditional water sources (wells, rivers and streams), due to lack of protection (no laws or law enhancement) for this type of source, can reduce real household income, notably by obliging

them to purchase bottled drinking water, to make use of health services to treat water-borne diseases or buy making them lose their income as a consequence of poor health. Increasing fuel prices can also cause a drop in real income, due to the cost of boiling water. In interviews with the respondents, five families claimed to spend seven to 10 per cent of their family income on water. This is relatively high, compared to the standards set by some international organizations, suggesting that a household should not spend more than three per cent of its income on water (Dagdeviren, 2008).

The implementation of PUSH in 2009-2010 in Kampung Kojan has helped reduce faecal pollution in the environment. Before PUSH was introduced in the neighbourhood, open defecation along the water bodies was commonplace.[19] Mercy Corps continued PUSH and made funding available to initiate community business of septage desludging and a revolving fund in other kampungs to self-finance the construction of improved septic tanks. The NGO introduced small vehicles that are able to pass through small alleys in the Kampung and believed that the septage hauling services can adapt to different household socio-economic conditions. However, the experiences of PELITA, the community desludging enterprise founded by Mercy Corps, show that these services are economically poorly sustainable. Muhasan, the coordinator, explains:

> If it is only one call [to desludging septic tank], we don't go [this is often the case] … the operational cost would be too high. We have to pay for two workers and their food … the fuel [to operate the machine] and [a fee for] the municipal truck [hauling the sludge to the final treatment plant].[20]

In sum, the retail services of drinking and clean water as well as public latrines and the septage-hauling provisions in Kampung Kojan perform only small roles in the overall multi-scalar yet heavily territorialized water-wastewater cycle. The effectiveness of these services is highly dependent on the more advanced environmental and water resource management

system that has been primordially organized to the benefit of (multinational) water companies and their privileged clients (corporate sector, elite settlements, state administrations). Reciprocal relations involving limited numbers of individuals who engage in personal contacts support these small-scale provision systems; but these particular networks of social relations are fragilized by the regular market economy that treats water as a commodity and continuously re-imposes cost and profit criteria. Having a high level of porosity, the community productive-reproductive membranes are easily penetrated by the solid fluidity of pro-market institutional mechanisms reinforced by a lackey state thus mutating many forms of affective and nurturing activities within communities into day-to-day survival strategies (see also Miraftab, 2005). Yet the interaction between the different forms of water sanitation services within the diverse production-scape of Jakarta does not only reveal vicious circles of commodification of use values causing impoverishment of people in kampungs, but also opportunities for integration of different types of services, their technology and their modes of governance into a sustainable ensemble of socio-infrastructural networks. In these networks both the communities and particular civil society actors can play an innovative and proactive role. Layer 3 on the institutional dynamics of the water and sanitation services will enlighten us on these contradictory evolutions.

5. SPATIAL DEVELOPMENT PATTERNS AND DIVERSE INSTITUTIONALIZATION IN THE WATER AND SANITATION SECTOR

The 'institutionalization of the city' involves what Moulaert and Lambooy (1996) call an interplay between formal and informal institutionalization of socio-economic practices and processes. As far the water provision and sanitation sector in Jakarta is concerned, at least the three following institutionalizations and their interaction should be considered: (i) the state-led, global corporate sector steered neo-modernist planning system; (ii) the decentralized procedures applied by real estate developers and tolerated by the state in the settlements of the (new) middle classes; (iii) the informal institutionalization of water provision and waste water handling in the kampungs. In kampungs, civil society organizations including international and national NGOs have played a significant catalysing role but also that of a mediator between the state, the corporate sector and kampung communities. Like the socio-economic water system itself, as illustrated in the previous sections, these institutionalization

processes are porous and influence each other. Regularization of the informal practices and habits, informalization of market mechanisms, complementarity between modes of local state service and self-provision, etc. continuously influences each other.

5.1. State Spatial Planning: Corporate Logic and Failing Delivery System

Jakarta's first wastewater plan was actually developed in 1977 and follows in the tracks of the neo-modernist systems for waste water treatment of both the colonial and post-colonial period: centralized, technology driven and built by or in close cooperation with the corporate sector. Only a small part of the plan was implemented. This part coincides with the contemporarily existent state sewerage system that covers only two per cent of the Jakarta urban area. (PDPAL Jaya 2010).

The philosophy of the most recent Master plan (2012) in which the national government, the provincial administration, the national public works agency and Japanese consulting firms were involved brings a more realistic picture and observes that Jakarta cannot be served with a single centralized system, but should be divided into fifteen zones of sewerage networks with separate wastewater treatment plants (Paper 3). The 2012 Master plan advocates local, individual or communal systems and incorporates institutional guidance for sustaining infrastructures (Yachiko Engineering 2010).

However, despite some good ideas major flaws remain: it counts on the market sector for building the new infrastructures; it pays only lip service to the integration of the diversity of on-site treatment technologies, while favouring the building of the centralized networks; it misperceives both the geological and spatial structure of the local communities and in particular the slums and offers no concrete strategies to improve the on-site or smaller network systems that would work better in these areas; and, last but not least, no necessary legal frameworks, administrative regulations or resources have been provided to implement the plan. The most explicit expression of this policy vacuum is that till today no agency is responsible or has the means for the overall sanitation development policies in Jakarta. As a consequence, communities have increasingly relied on self-sufficiency or, in cooperation with local (district) authorities and NGOs, have developed (fragmented) small-scale service networks as illustrated in the previous section on informality.

5.2. Privileged Settlements and Their Water-Sanitation Procedures

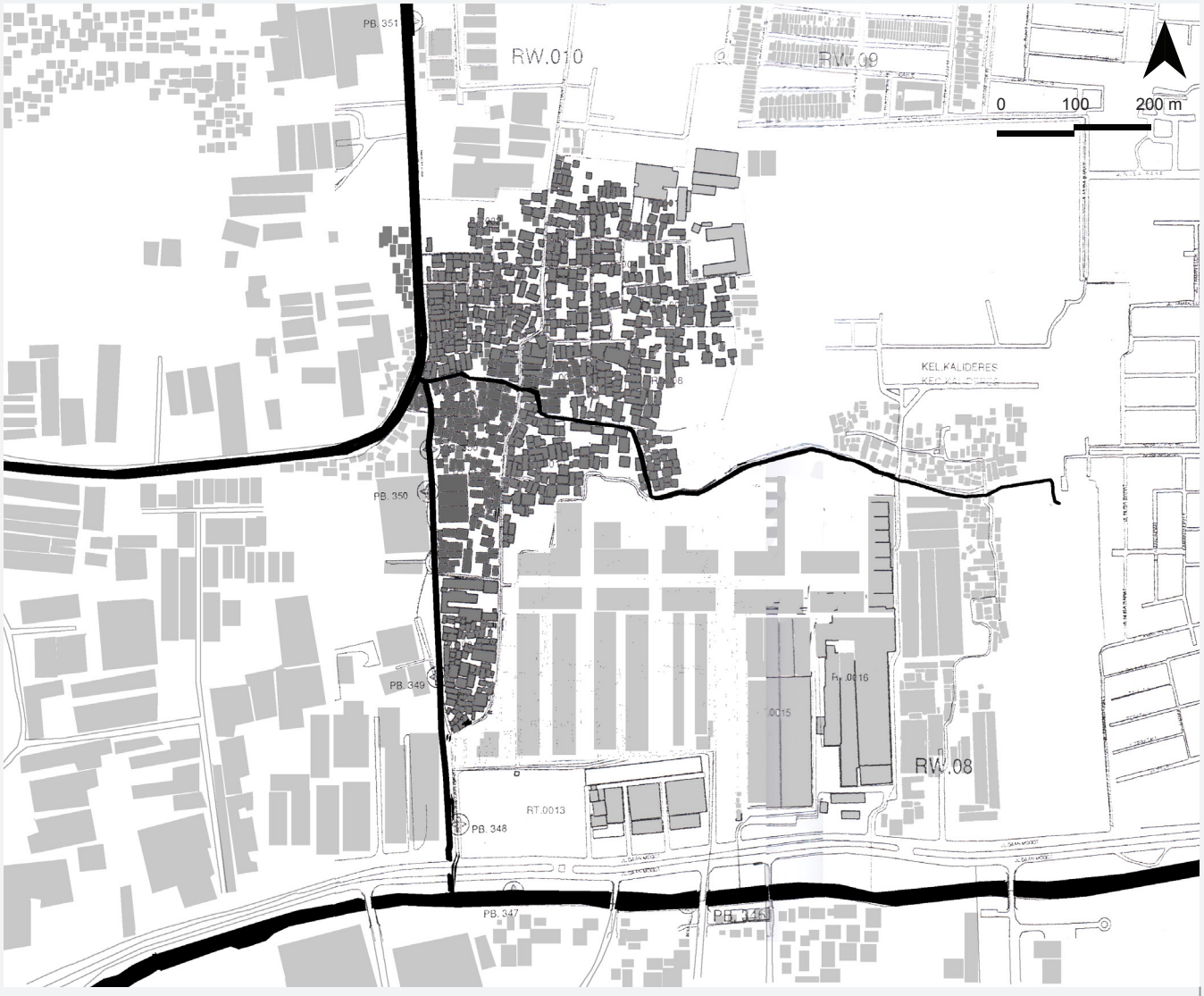
One of the social developments that has accompanied and nourished Jakarta's post-colonial economic growth is the rise of the middle class (Evers & Korff, 2000). This population group has become a privileged focus of spatial planning in Jakarta (see Firman, 2002; Goldblum & Wong, 2000; Rimmer & Dick, 2009). There is a high discrepancy in facilities provided to rich and poor settlements. Rich settlements benefit from state-led investment in public squares,

Figure 2. Spatial fragmentation in Kalideres sub-district and Kampung Kojan
Source: redrawn by the main author based on Jakarta Master Plan 2030; and data and district-maps owned by Jakarta Housing Agency (2004 and 2008)

commercial facilities and gated residencies (Cairns, 2002; Dorleans, 2000; Firman, 2004; Goldblum & Wong, 2000; Kusno, 2002, 2010). Kalideres sub-district and its surroundings are a microcosm of Jakarta's spatial segregation (see **Figure 2** below).

In general upper class settlements are equipped with small-scale collective water infrastructures utilizing advanced technological devices. In the absence of satisfactory state-led service provisions this has been the strategy of many property developers to meet the needs of clean water supply. One developer has expanded the canal that passes Kampung Kojan,

B. KAMPUNG KOJAN



to channel the water to a private water treatment facility. Thanks to Mercy Corps and its sanitary education programme and the septic-tank construction projects open defecation in the Kampung has ended, pollutants in the canal significantly diminished, and the water became treatable to serve the middle class housing estates in its surroundings. Moreover, various nearby factories, often illegally, exhaust the groundwater in the area through digging artesian wells.[21]

Many experts have urged the provincial government to forbid private enterprises to overuse groundwater because this increases saltwater intrusion and land subsidence problems in the coastal area. The government of DKI Jakarta has responded to this issue by increasing the groundwater tax significantly. But this has had an adverse impact as the tax reduced the revenue of PDPAL Jaya, the provincial wastewater company that manages the sewerage system in the central parts of Jakarta. The regulation has made many proprietors of high-rise buildings recycle their wastewater as an alternative water resource, instead of discharging it to the sewers. Some private enterprises have opted to disconnect from the sewerage network. An engineer of the provincial state company clarifies:

> This has been a challenge … they want to recycle their wastewater [for machinery cooling and cleaning purposes], but we are not ready to. We treat wastewater to reach the quality of 'not-harming the environment' [instead of the standard quality for reuse].[22]

While many high-rise buildings, including luxurious apartments, have been equipped for recycling wastewater, the housing estates surrounding Kampung Kojan built since the late of 1970s do not have collective wastewater treatment facilities. One director of PDPAL Jaya explained that the regulation for wastewater management had not been strictly applied for developers of landed houses. Developers must connect their housing estates to the sewerage network if the main sewer passes through the area, otherwise they should provide their own collective systems. He added:

> But this [technical requirement] has not been enforced by law…. We haven't had a [mandatory] guideline for developers … [for example] one collective system for every 30 units …. There is no definitive master plan … [it has not been decided if] certain collective systems [are] suitable for this or that area.[23]

These regulatory biases were confirmed by the Head of the Planning Agency of West Jakarta Municipality that is responsible for regulating spatial development in Kalideres Subdistrict. He declared:

> We issue planning permits for developers utilizing a land. For areas above 5,000 square metres, we give planning advice [to follow] … the size of the land parcels, land ratio for roads … open space … drainages … but not for wastewater treatment systems.[24]

Middle and upper class people often consider kampungs as settlements of polluters, of sanitary illiterate populations. But in reality, the privileged housing estates do not practice better environmental sanitation than the kampungs. Households there also utilize individual

septic tanks that are often unreliable.[25] Still, if faecal wastewater overflows from individual tanks, these housing estates are equipped with good drainage systems that are designed to discharge unwanted water away from the estates. Although households in housing estates also bear the responsibility of sanitation and health through various modes of individual consumption, in these particular neighbourhoods, there is a better organized supply of local infrastructural networks. Indeed, this better quality infrastructure enhances population stratifications manifested in residential patterns - as housing is a conspicuous consumption good that reflects income diversity within cities (Saunders, 1984).

5.3. Informal Institutionalization of Water Handling in the Kampungs

At this point, it can be stressed that institutionalization of water supply and sanitation services adopts different forms in different settlements. This is not only in the ways households embedded in different social contexts satisfy their basic needs individually and develop 'new' habits, but also through associative regulatory processes in response to informalization dynamics (see Mingione, 1991, pp. 85, 132, 262-265) or to failing or biased state regulation.

Fieldwork in Kampung Kojan revealed that civil society organizations can have a significant catalysing role in building new associative relations. During Mercy Corps PUSH project, tenants were willing to collectively build new latrines while Mercy Corps helped construct shared septic tanks. Around 35 semi-private septic tanks were constructed and they benefited the people living in rental settlements, who are generally the poorest members of the community. Access to a toilet that is located near their rooms and has a tap-water connection enables women to enjoy more privacy in their sanitary activities, and save more time for other (domestic) works that may increase their real income. Modes of usage were developed stepwise and interactively.

NGOs like MercyCorps are no developers but seek to make creative use of the porous social space between informal community life, the ambitions of the districts and sub-district authorities to cope with the regulatory vacuum left by the national state and the ambiguous views of corporate players on how the commodification of water and water sanitation services should proceed. Local inhabitants might benefit from initiatives led by NGOs, as shown above, but it remains an open question under which conditions urban populations can act as active communities capable of controlling their social reproduction spheres in ways to improve the wellbeing of the community members, and keeping them from becoming passive consumers instead of active citizens (see also Hofmann, 2011; McFarlane, 2008; Simone, 2010).

6. CONCLUDING REMARKS: TOWARDS COMMUNITY-BASED GOVERNANCE OF THE HYDROLOGICAL SYSTEM

This paper explains the complex configuration of socio-ecological conditions from which different types of water provision and sanitation services emerged to meet the needs of rivalling human activities, communities and territories in Jakarta. The analysis makes use of three interconnected layers: the historical-geographical metabolic development of the socio-infrastructural water provision and sanitation system; the role of informality in meeting water and sanitation needs in interaction with the state and corporate sector; the multiple and interconnected forms of institutionalization of water and water sanitation service provisions. It is especially questions about the potential of these institutionalization dynamics that guide us in this conclusion. *What do the three layers of analysis tell about this potential?*

The first analytical layer provides a basis to understand that the contemporary socio-ecological system is the historical-geographical outcome of a development trajectory in which diverse human technological and social practices have addressed water provision and sanitation needs. However, as became particularly clear from the deconstruction of the modernist logic, these practices have not produced a coherent ensemble of city-wide infrastructures serving the needs of the different urban population groups but a patchwork of infrastructures and networks that are territorially conflictive and socio-politically exclusive. Yet this diversity of modes of sanitation offers a rich laboratory of opportunities for applying more decentralized technologies and how they can be integrated into a city-wide ensemble of water and sanitation services.

The second analytical layer stresses the osmosis between the formal and informal water economy, especially at the neighbourhood level. It highlights the characteristics of the informal sector: traditional and modern practices of water provision and sanitation by households, groups of inhabitants, small enterprises; modes of cooperation based on reciprocity but also on lose forms of association with corporate players and state agencies; high level of adaptability to changing socio-ecological conditions. Osmosis with the 'formal' market and state sectors is all-over and confirms the necessity to consider informality as the community based twin antagonist of market and state regularity. Synergies between them are the crux of sustainable institutionalization in the Jakarta world of water provision and sanitation services. This institutionalization is a mixture of building habits and codes of cooperation at the level of

kampung or district, of establishing procedures of water and network-use rights among major players (developers, industries, groups of tenants, …), of unsatisfactory yet influential state regulation, etc.

The third layer then examines how these modes of institutionalization have hampered or reinforced each other, or mutated; how they have negotiated symbiotic forms of service provision. Such symbiotic forms refer to both the technologies that are combined as well as their modes of operation and regulation. These symbiotic forms, it is found, hold a great potential for building an integrated yet diverse water and sanitation service system across Jakarta's Kampungs.

The failure of the formal systems, on the one hand, and growing informal basic sanitation service provision, on the other hand, have driven the state and private sector to integrate and institutionalize informal practices within the current development model (see Gerlach & Franceys, 2010; Hardoy et al., 2005). By regulating informal services, including standardizing service quality and increasing the scale of operations, the state and private sector assume that proper basic sanitation service provision for all can be achieved. It is not a matter of recognizing and regulating the systems outside the piped infrastructure networks – name these systems 'informal', 'low tech', 'non-state', 'community', or 'decentralized' - by integrating them into the piped networks that are governed by institutions instigated by the corporate sector and operated by the central state. This would just lead to a further loss of control of the water cycle by the urban communities, especially those in the kampungs. Instead it is a matter of recognizing different technologies and infrastructure governmentality and providing them with a multiplex but coherent governance system.

As argued by Mingione, '[the] Informalization process has served to increase the importance of some local characteristics as against universal patterns' (Mingione, 1991, p. 177). The three layer analysis shows that institutional hybridization in a capital driven society can put reciprocity, the basis principle of informality under pressure. But other forms of informalization in which the reciprocity networks are improved are possible (following Mingione, 1991; Mingione, 2002). Highly informal community services often function as both productive economic and socially reproductive activities that sustain the wellbeing of the community members. Improved reciprocity networks can be associated with community-managed closed water-wastewater cycle with relatively autonomous environmental sanitation systems that are able to ensure public health and sustain bio-hydrological balance at the local level.

NOTES

1 An official of PDPAL Jaya during interviews with the author on 7 and 20 January 2011

2 An official of Jakarta Cleansing Agency during an interview with the author on 27 March 2012

3 A technical expert of PALYJA in interview with the author on 8 November 2010

4 Official presentation of the chief director of PAM Jaya, 30 June 2011

5 Several government officials during several interviews with the author

6 Sessions and discussions during the national conference of water and sanitation on 18 January 2011 and 2 September 2009

7 Some community members in several conversations with the author

8 Data from RW 6 leader, October 2011

9 In the Kampung, of the 34 landlords listed as beneficiaries of Mercy Corps, 29 own less than ten rooms The Program of Urban Sanitation and Hygiene Promotion, Mercy Corps 2010

10 Interview with the owners, 12 January 2012 and 22 August 2013

11 Interview with the owner, 22 August 2013

12 A programme manager of Mercy Corps during an interview with the author, 1 October 2010

13 The leader of Neighbourhood Unit 7 (RT 7), in conversation with the author 5 October 2011

14 Echelon II official, the National Development Planning Agency, during an interview with the author on 5 November 2010

15 A founder of Green Building Council Indonesia, during an interview with the author on 18 November 2011

16 Suanah and Saroh were interviewed on 22 September and 22 October 2011

17 Kartini was interviewed on 22 September 2011

18 These respondents were selected from the list of Mercy Corps' beneficiaries

19 Mercy Corps field officer during an interview with the author on 06 August 2011

20 In conversation with the author on 21 December 2011

21 A local leader of Kalideres and a founder of Kalideres Cooperative, in conversation with the author on 08 November 2011

22 During an interview with the author on 17 January 2011

23 During an interview with the author on 20 January 2011

24 During an interview with the author on 09 January 2012

25 An official of Building Authority Agency (Dinas P2B), North Jakarta Municipality, during an interview with the author on 19 October 2012

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II.

SANITIZING URBAN KAMPUNGS IN BATAVIA/ JAKARTA

A CRITICAL HISTORY *

Abstract

This article discusses the history of environmental sanitation in Batavia (Jakarta in the Dutch colonial era) in relation to the city's development beyond the trajectory of modern colonialism. It seeks to improve current understanding of the socio-ecological dynamics of Jakarta's urban kampungs, in which disparities in basic sanitation infrastructure services persist. Dutch colonists introduced a new urban socio-spatial configuration, and industrialization in the Colony led to the birth of modern Batavia. However, these dynamics also caused the decline of community socio-ecological traditions in managing water sources and living environments. The (colonial) state as a collective institution opted to implement modern water and sanitation infrastructures, but failed to serve the urban poor in many areas in the city. Meanwhile, within contemporary socio-spatial configurations, communities have been unable to respond collectively and provide basic sanitation services. This article highlights some of the key spatial development issues that must be addressed in order to formulate an appropriate response to the heterogeneous socio-ecological problems in Jakarta, especially in the kampungs.

* A shorter version of this paper has been resubmitted to *Planning Perspectives*

1. INTRODUCTION

Academic scholars across the world have analysed unequal access to basic sanitation services by debating contemporary conditions and reviewing history. This article seeks to enrich these debates by examining the geography of uneven development in Jakarta during the colonial and post-colonial eras, to further reflect on sanitary conditions of urban kampungs today. 'Kampung' is an indigenous term for a rural-agricultural settlement. In the colonial period, it was also used to label non-European and non-Chinese settlements in and around the city. An urban kampung is a socio-spatial entity that can be categorized as an informal settlement, but it is highly characterized by formal dynamics involving the state and formal sector workers (see, among others, Simone, 2010; Winayanti & Lang, 2004).

Neoliberal economic strategies have been identified as the main cause of inequalities in contemporary cities, including the inequalities caused by discrepancies in the provision of water and sanitation infrastructures. Graham (2000) points out that urban infrastructure development is no longer organized by the national state as a single bundle of services. Services are now unbundled through various types of privatization and liberalization, following the decentralization of political and regulatory regimes that used to comply with the public infrastructure monopolies (Graham, 2000; Graham & Marvin, 2001). Only areas with greater 'needs' and stronger purchasing power are served, causing infrastructural resources to be concentrated in so-called 'premium networked spaces' (Graham, 2000). This complies with efforts redefine city centres and increase city competitiveness by attracting 'spatially mobile investors' (Rogerson et al., 1996; Simone, 2010). Similar privatization strategies have been applied to water services in cities across the Global South, meaning that the market is now highly influenced by the agendas of global water enterprises (see Argo & Laquian, 2004; Bakker, 2003; Braadbaart, 2005).

After Graham and Marvin (2001), some scholars have criticized use of the analytical concepts of 'unbundling' and 'splintering urbanism' in understanding contemporary urban dynamics. These scholars demonstrate that today's inequalities in access to basic infrastructure services are not merely caused by neoliberal economic agendas (see, among

others, Coutard, 2002; Kooy & Bakker, 2008a). As Coutard (2002) argues, industrialized nations have also experienced disparities in infrastructure service access and quality, even at times of monopoly state provision; as such, the new structure of global capital is not the sole cause of uneven infrastructure development. In cities of the Global South, 'fragmented' water-related services existed during colonialism. This fragmentation did not emerge in the 1980s, when the state began to involve the private sector more widely in urban development and public service provision (Kooy & Bakker, 2008a; McFarlane, 2008a).

Furthermore, it is also important to note that the neoliberal economic regime takes specific forms in specific localities, and that its development across time is also dependent on the continuously evolving roles of state institutions (see Harvey, 2005; Lambooy & Moulaert, 1996; Mingione, 1991; Swyngedouw, 1997). Many studies show that post-independence basic sanitation infrastructure development in the Global South was not improved because of corrupt politicians and the absence of welfare policies (among others, see Kooy & Bakker, 2008a, 2008b; McFarlane, 2008a, 2008b). It can be argued that this kind of political, post-independence context provided fertile ground for the neoliberal profit-oriented strategy of basic infrastructure development; Liddle (1991) has discussed this extensively as regards Indonesia. Many water-sanitation privatization schemes launched in cities of the Global South have not brought about any significant increase in access to basic services, but have enriched private companies and some officials (see Ardhianie, 2011; Argo & Firman, 2001; Bakker, 2003; Bakker et al., 2008; Braadbaart, 2005, 2007).

Spatial planning instruments are also part of the state apparatus. Spatial planning regimes direct and regulate growth poles, as one of several ways of directing public funding for key economic entities (Graham, 2002). Basic infrastructure provision that used to be regulated by the state has been turned over to the private sector or deregulated, and high-investment, large-scale infrastructure development has become a new arena for capital accumulation (Harvey, 2005). However, spatial planning can also embed policies that advocate equality (Mollenkopf, 1983), and its processes can orient initiatives to build a just city by allocating resources fairly (Campbell, 1996).

Informed by the various insights discussed above, this article re-visits the past but refuses to take the concepts, routines and regulations of a certain planning system for granted (Huxley, 2010). Rather, it adopts a critical historical approach that questions everyday assumptions of 'planning' to open up creative possibilities for change (see Huxley, 2010; Sandercock, 2003). Planning is more than a field for exercising the urban visions developed by great thinkers (Huxley, 2010). As Sandercock argues, alternative planning histories can be revealed by looking beyond the modernist planning paradigm (see Sandercock, 2003).

This paper is organized as follows. Section two discusses the transformation of agricultural-based traditions in place-making before the twentieth century, explaining the typical socio-spatial change in rural kampungs around the walled-city of Batavia. Section three discusses the modern planning system implemented by the colonial government of Batavia. It reviews the strategies used by the colonial government to discipline urban life alongside the development processes deployed to modernize and sanitize the city according to modern (European) ideals. Section four shows that evictions of communities from Jakarta's urban kampungs increased after the mid-1980s, due to mega-scale development projects. In this context of post-colonial urban development, a city-wide environmental sanitation programme was no longer deemed to be a primary public sector concern. The final *section* concludes and reflects on the contemporary socio-ecological condition of urban kampungs, in which community survival strategies have been influenced by the trajectories of multiple spatial development process.

2. TRADITIONAL KAMPUNGS AND EARLY NINETEENTH CENTURY BATAVIA

Javanese kingdoms played a significant role in several trade networks between China, India and the Middle East, which had co-existed in Southeast Asia for centuries, and which had developed to various extents when the Dutch colonists transplanted the capitalist world economy to the region (see Ray, 1995). Pre-colonial income structures in Java were built on various subsistence production systems (fisheries, agriculture and hunter-gatherer systems) that were linked with small-scale commerce (Ibid., 1995). As part of the regional retail systems that involved Asia-wide traders, traditional inland trade was fragmented into a numerous small, isolated person-to-person transactions conducted in several market nodes (Alexander & Alexander, 1991; Christie, 1991; Ray, 1995). The new (re)configuration of international trade in the sixteenth century incorporated more powerful European networks, causing a decline in existing Asian trading networks (see Alexander & Alexander, 1991; Ray, 1995). However, these regional networks continued to function within their own spheres, subordinately co-existing with international trade (Ray, 1995). The wholesale trading system and, later, industrialized agriculture introduced by the Dutch transformed the pre-existing household income structure (monetary and non-monetary) and its spatial configuration.

The capitalist economy opened new networks that actuated mobilization and simultaneously drove new, bigger and denser agglomeration of population. Batavia was one of the products. It grew from a small fort that originally provided logistical support for the Dutch trade company, VOC (Vereenigde Oostindische Compagnie). Wanting to establish a regional head office, VOC built the walled city of Batavia in 1619 by gradually destroying Jayakarta, a trading port of the Banten Sultanate. VOC mobilized slaves, workers and regional traders from China and islands outside Java to construct and populate the new town (Blussé, 1981; Ray, 1995).

Pre-twentieth century Batavia had two major spatial enclaves: the walled city that predominantly comprised the technologies of colonial governmentality, and the surrounding kampungs, the socio-economics of which were strongly embedded in ethnic traditions. When the city was built, there had been enclaves where other Asian traders, long-standing market-players, settled, as well as the surrounding indigenous villages. Up to the twentieth century, Arabs owned significant plots of land, which gave them significant power to negotiate with the Dutch administration (see Gunawan, 2010). Indigenous settlements grew up in the southern part, relatively far from the walled city; communities preferred not to build housing on the low marshy land in the northern part, as they were unable to deal with natural flooding (Gunawan, 2010, pp. 9,10; Putri & Sari, 2010). They used the marshy lands for agriculture only (Gunawan, 2010).

Figure 1, left, shows the spatial fragmentation of settlements in eighteenth century Batavia. Kampungs were organized by ethnic group, around the walled city that housed the Europeans and some elites from other races. Some kampungs grew up close to natural streams and on relatively high ground. The colonial government actively influenced this fragmentation. Sugar plantations expanded as of the 1670s, generating an increasing influx of Chinese farmers and traders who settled outside the walls, beyond the close control of the city authorities (Blussé, 1981). However, after the 1740 riot against the Chinese, the state restricted their settlement to specific territories. Meanwhile, indigenous communities continued living in separate enclaves, due notably to their lower position in the colonial economic structure and their attachment to different traditional socio-economic spheres (see Blackburn, 2011; Blussé, 1981; Booth, 1988; Elson, 1986; Ray, 1995).

Indigenous populations responded to the exclusion and oppression imposed by the colonial regime by living with or close to specific ethnic groups and maintaining traditional socio-economic networks (see Guinness, 2009). Indeed, their participation in the capitalist economy was limited to jobs that generated a very low income, and they were excluded from more strategic roles in the economy (Alexander & Alexander, 1991; Booth, 1988; Elson, 1986; Ray, 1995). As such, communities continued to rely on subsistence agriculture and fishing, working on their own or rented land, in between several (seasonal) jobs as labourers, coolies and crafters (see Booth, 1988; Elson, 1986). These traditional economic activities were manifested in heterogeneous working time and blurred borders between working and living space (see Christie, 1991; Mingione, 1991; Reid, 1980; Waterson, 1997). Subsistence agriculture made the kampungs greener and less dense than the walled city and its vicinity. Communities used surface water for washing and bathing. Agriculture and fishery activities in the kampungs kept the natural cycle of water functioning in people's immediate environment, i.e. their compounds. They had their wells and streams as well as water purification systems in the form of wetlands and other natural infiltration wells.

In the walled city, the Dutch colonists introduced a new urban culture; working space was clearly separated from the domestic world of social (re)production. Modern canals functioned for transporting goods to warehouses and factories, while brick houses built along the canals symbolized the modern domestic life of European workers and their families (see Blackburn, 2011; Veering, 2008). Batavia was built to resemble its sister city, Amsterdam, adopting an 'offensive spirit' to engineer the nature (Hooimeijer, 2009). The Dutch colonists introduced a new attitude towards water by occupying the marshy land in

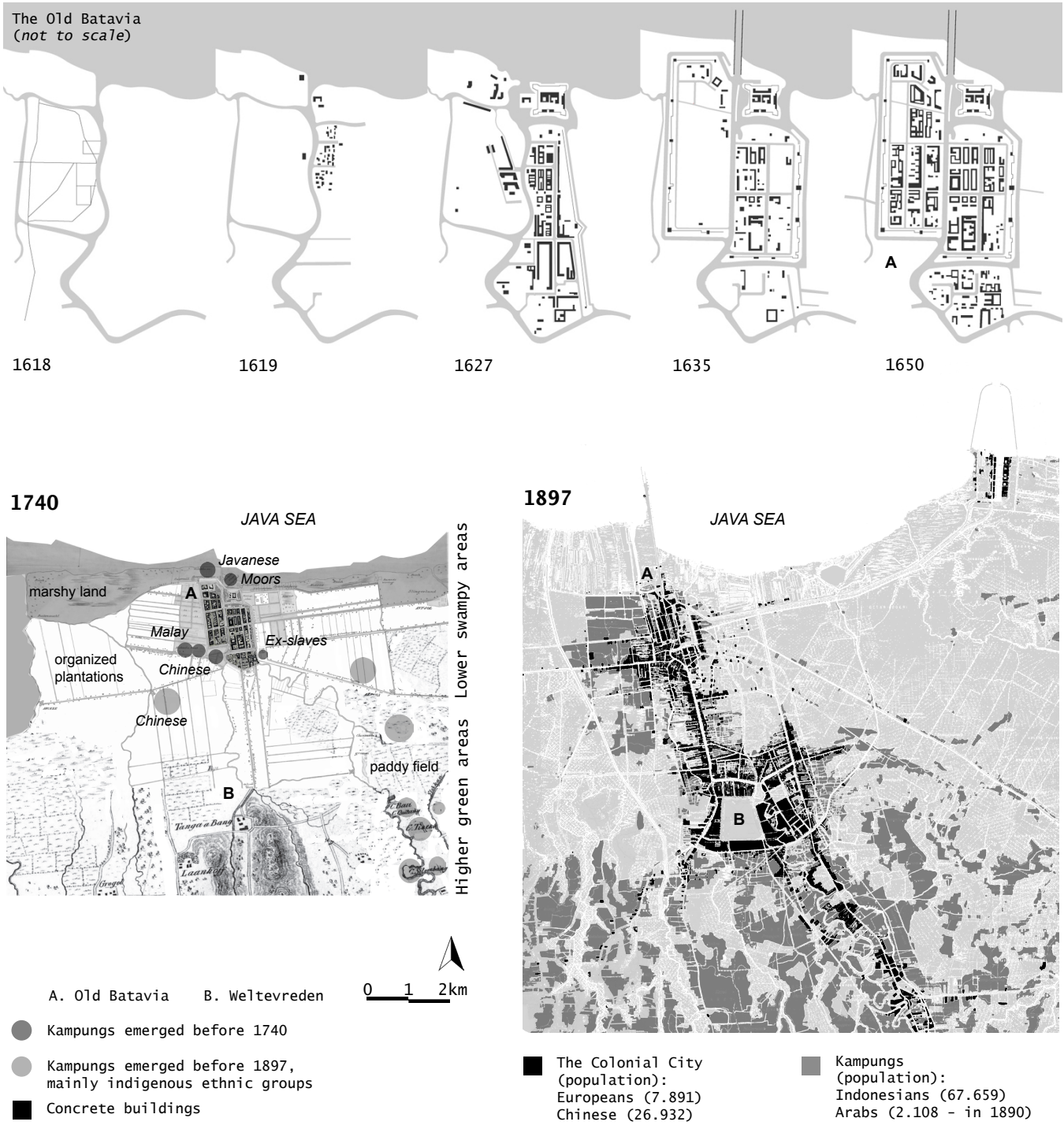

Figure 1. The transformation of Batavia up to 1897

Source: collage of maps compiled by the author: Batavia 1650 (Blackburn, 2011), Batavia 1740 (courtesy of KIT/ the Netherlands Royal Tropical Institute), Batavia 1797 (KIT, the Netherlands), Batavia 1846 (Wikipedia), Old Batavia evolution (Putri & Sari, 2010)

a way that was unfamiliar to Javanese traditions. Rivers were made straight and bordered by concrete walls, new canals were dug and the excavated soil was used to erect foundations for buildings (Caljouw et al., 2005).

Unfortunately, the Dutch engineering system was challenged by Java's ecological setting, which was very different from that of the mother country. The canals did not function as expected because precipitation was heavier and rivers carried thicker silts from higher areas; as a result, the canals became blocked and filled the city with stagnant water (Kop & Ravesteijn, 2008; Ravesteijn, 2008). In 1733, a malaria outbreak drove a substantial increase in mortality, from around 500 people (6-10 per cent of population) in the earlier years to more than 2,000 people (40-70 per cent of population) (Van der Brug, 2000). The walled city of Old Batavia came to be seen as unhealthy.

Concerned for their health, rich people gradually left the city and moved to the southern areas: *Molenvliet*, *Noordwijk*, *Rijswijk*, and *Weltevreden* (Blackburn, 2011; Van der Brug, 2000). This gradual migration of the European population transformed the urban dynamics outside the walls. In 1730, there were already 15,000 people living close to the town while the population inside the walls totalled 20,000. In 1810, the colonial government officially moved the town centre from Old Batavia to the southern area called *Weltevreden* (see Figure 1).

Many communities were evicted from existing kampungs to enable construction of the new centre in *Weltevreden*. Meanwhile, in rural areas across Java, subsistence agriculture land had been seized for export-crop plantations, causing forced migration to urban areas as people search for new income sources (Elson, 1986). Over the nineteenth century, the whole of Java was brought under the control of Dutch colonists; this also led to a great influx of Javanese into Batavia, because indigenous populations were no longer considered a danger to political stability and thus no longer forbidden to live in the capital city (Blackburn, 2011). Batavia's remaining kampungs accommodated newcomers from rural areas and the evicted communities, and thus grew faster and became denser. The land available for household agriculture and fishery decreased, destroying community ecosystems. Poverty and the incidence of cholera increased in the kampungs (see Booth, 1988; Elson, 1986).

3. MODERNIZING THE COLONIAL CITY AND DISCIPLINING URBAN LIFE

3.1. The Birth of the Modern State and Development of Large-scale Urban Water Infrastructures

The trade company, VOC, was liquidated in 1789, when it was nationalized and requisitioned by the Netherlands. Dutch colonialism in the East Indies (now Indonesia) started to be formalized and several governmental organizations were formed for and in the colonies (De Jong & Ravesteijn, 2008). The first liberal policies were implemented as of 1870. The end of the forced cultivation system and the adoption of the Agrarian Act enabled private enterprises and individuals to participate in trading. They were allowed to rent land for 20 to 75 years (Reerink, 2011; Van Roosmalen, 2011). There was

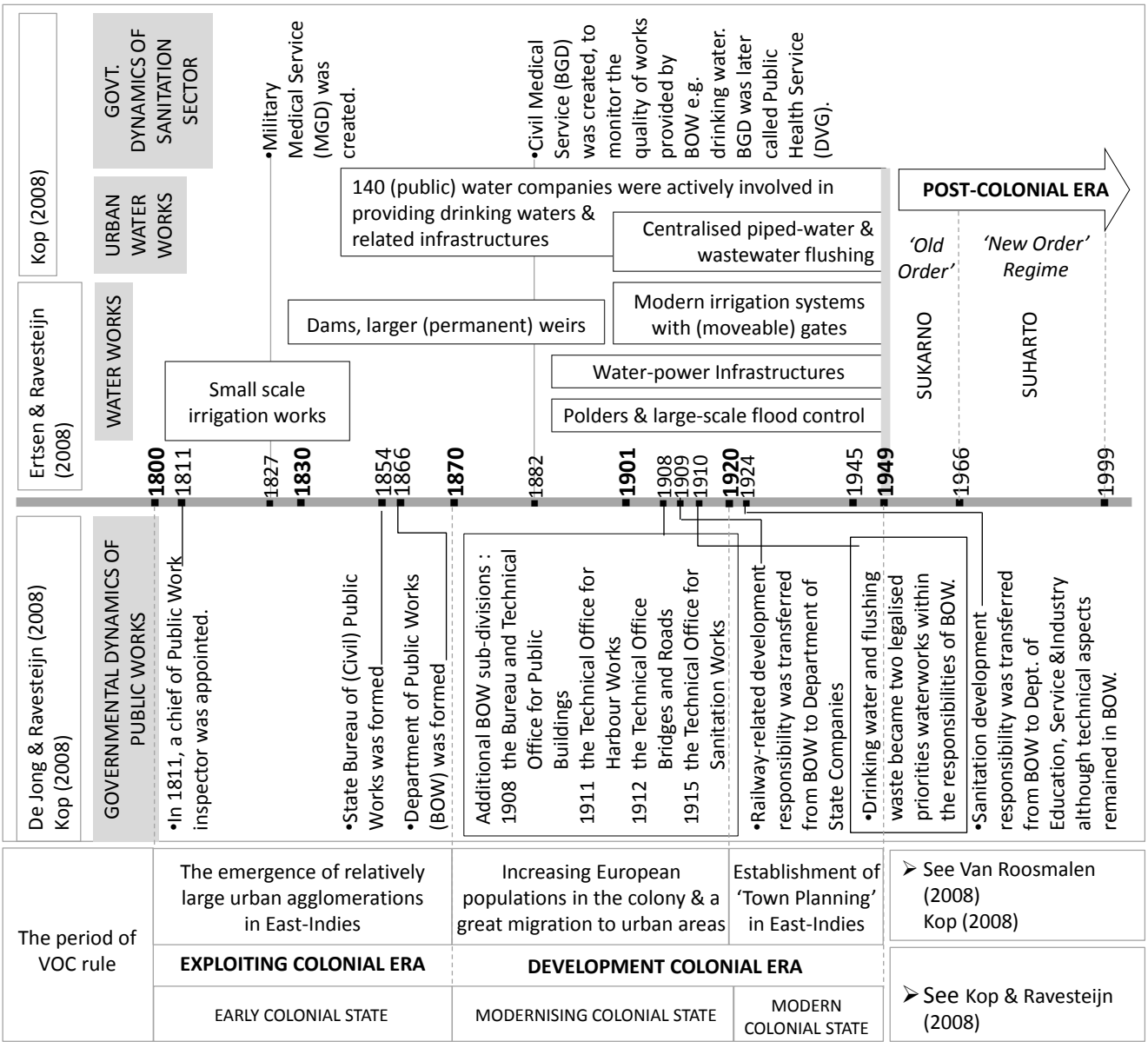

Figure 2. The modern state and water engineering works in the Dutch East Indies

Source: compiled by the author

a huge influx of Europeans to Batavia between 1870 and the 1930s (Kop, 2008; Van Roosmalen, 2008), and this also triggered several governmental changes and new development policies.

Created in 1866, BOW (the Department of Public Works) became the leading colonial era governmental agency specializing in water engineering (De Jong & Ravesteijn, 2008). It developed many large-scale water works that formed an important part of the colonial landscape, as they heralded developmental progress and reinforced Dutch identity in the colony.[1] In the first half of the nineteenth century, the purpose of many large water projects in Java was to increase sugar production under the forced cultivation system (see Ambler, 1988; De Jong & Ravesteijn, 2008; Ertsen & Ravesteijn, 2008). However, the nature of engineering works changed over the rest of the century (see **Figure 2**).

Concentrated demographic growth also constituted a threat to public health. This led the state to shift the focus of engineering works from economic production alone to incorporate public health concerns. Sanitation became a crucial urban development issue in Java during the rest of the colonial era. The decentralization act of 1903 clearly stated that a municipality was responsible for ensuring quality public health and addressing new needs of housing and town expansion (see Blackburn, 2011; Niessen, 1999; Van Roosmalen, 2005, 2008). However, it can be claimed that policy formulation and implementation were race-biased. The presence of more Europeans led to a growing demand for good housing and environmental conditions (Blackburn, 2011; Van Roosmalen, 2011), and efforts to improve sanitary conditions in Batavia were deployed with a view to meeting the aspirations of new European settlers in the colony.

Table 1. Estimated Drinking Water Requirements in Batavia, 1890

Group of Population	Population Number	Drinking Water Requirements (l/d)
Europeans	7.891	150
Chinese	26.932	100
Foreign Easterners and Arabs	2.108	50
Native inhabitants	67.659	50

Source: Kop, 2008

A public water service was created in 1873 and, in the 1890s, pipelines were built to channel water into houses (Kooy, 2008). This provision of clean water generated a significant reduction in water-borne diseases (a health report cited in Kop, 2008), but not among indigenous or Chinese populations (Blackburn, 2011). By the 1920s, only 119 km of water pipelines had been laid, serving around 4,000 inhabitants (less than four per cent of the total population); the beneficiaries were mainly European, and a small number of Chinese (Kooy, 2008). In the late nineteenth century, engineer Van Breen developed an integrated network of canals and rivers that were designed for flood management, irrigation, flushing and as clean water sources. This water network protected the inner city of Batavia in which the Europeans conducted various socio-economic activities. **Figure 3** shows the spatial distribution of water infrastructures in Batavia during the first-half of the twentieth century.

The policy assumption behind the spatial distribution of water infrastructure networks, as shown above, was not to ensure access to water as a universal right. Native inhabitants were assumed to have less need for water than other community groups (see Kop, 2008). **Table 1** shows estimated drinking water requirements in Batavia at that time. Moreover, many Javanese bathed

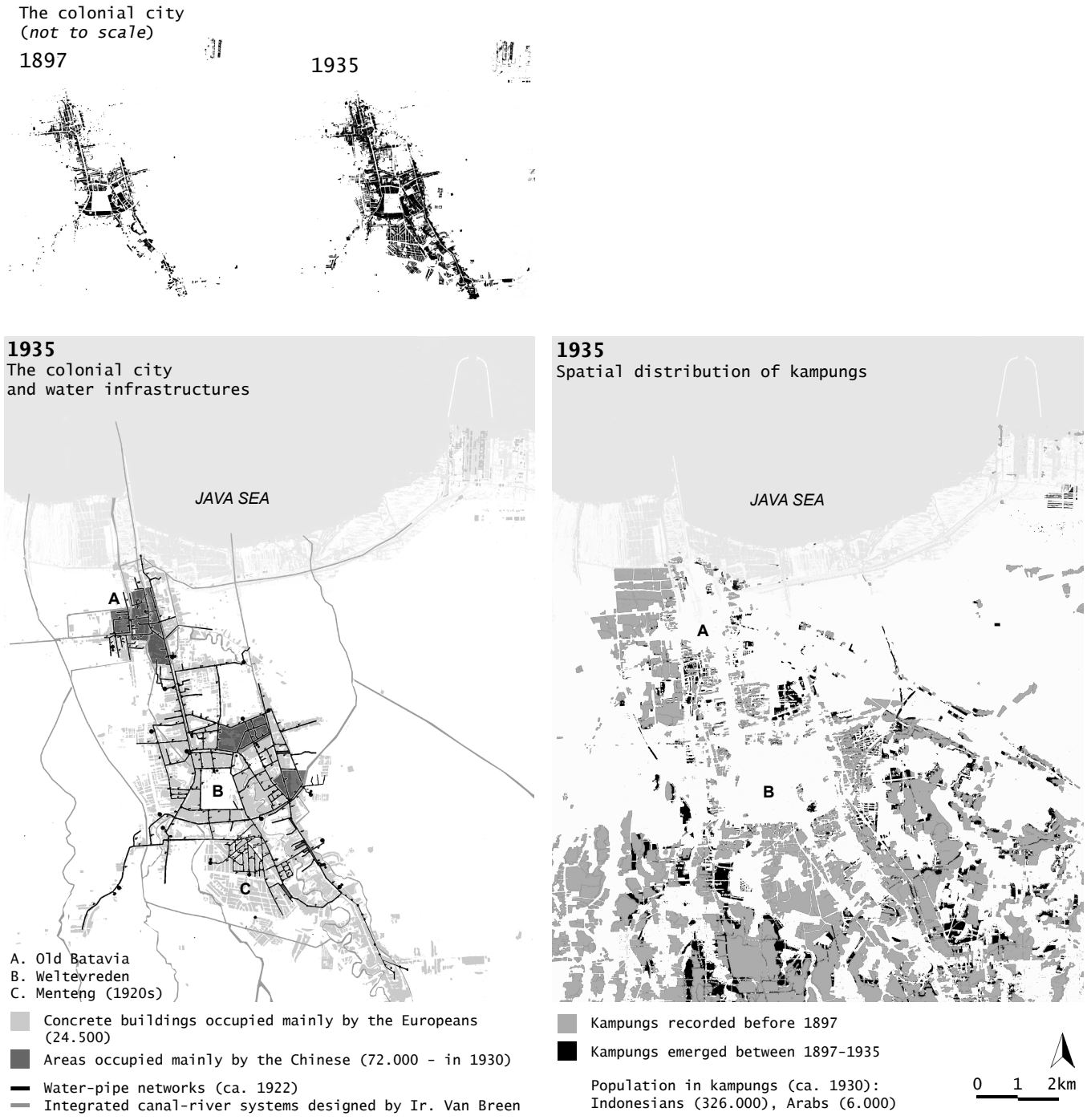

Figure 3. Batavia in 1935 and spatial distribution of the water infrastructure ca. 1922

Source: redrawn by the author based on several maps: Batavia 1897 & 1935 (courtesy of KIT/ the Netherlands Royal Tropical Institute), Batavia hydraulic situation 1900 (Kop, 2008), Batavia water networks 1900 (Kop, 2008), Artesian supply water networks in Batavia 1873-1922 (Kooy, 2008), Ethnic distribution of the population in Batavia (Abeyasekere & Owen, 1987)

collectively in public spaces designed for both social and religious ceremonial functions (Quinn, 2011; Van Dijk, 2011), and this was taken to imply that they did not want individual domestic connections (see Kooy, 2008). The policy makers did realize that different ethnic groups had different water consumption patterns, but this understanding merely served to legitimize the focus on meeting the needs of European populations while neglecting the preferences of others.

Following Chatterjee (2004), it could be argued that the colonial government treated the inhabitants as objects of race-based development policies, rather than citizens with equal rights to water and sanitation. Furthermore, the development policy was implemented based on physical planning knowledge acquired in nineteenth century Western Europe (see also Headrick, 1988). Rigid forms of infrastructure technology and governance were transplanted without considering, in contrast, emphasizing the geography of socio-ecological disparities.

As the colonial government had addressed the needs of clean water in Batavia by providing a centralized piped-water system, this naturally increased the volume of domestic wastewater. However, it did not introduce covered sewer networks or wastewater treatment plants. In nineteenth century Batavia, it was considered appropriate to deposit human waste in the ground or discharge it into open waterways; it was assumed that the soil would destroy any pathogens, while a fast stream would dilute the waste and wash it away (Kop, 2008). By the twentieth century, the government had realized that this practice was not sustainable and considered human and domestic wastewater a serious problem in Batavia, especially in the low lands. In 1910, flushing became BOW's second priority, after clean water provision, relegating irrigation and hydropower to lower priority levels (Kooy, 2008; Kop, 2008). However, flushing did not solve any environmental problems because it only discharged wastewater to lower areas, affecting many non-European settlements that had no proper drainage systems.

The following sub-section shows that further advancement in spatial planning helped increase discrepancies in access to water and sanitation through discriminative housing policies and public space provision systems. As sets of rationalities concerning populations and resources, state institutions are arenas of interplay between those who govern and the governed (Chatterjee, 2004; Kooy & Bakker, 2008a). In these arenas, the European ideals of sanitary behaviour were constructed through certain patterns of infrastructure consumption (Jewitt, 2011; McFarlane, 2008a). To enjoy access to state water and sanitation services, indigenous communities had to follow, and afford, particular standards of living that had been institutionalized by the government through, among others, spatial planning practices.

3.2. Modern Spatial Planning: Disciplining Urban Life and the Kampungs

After the election of a socialist government in the Netherlands, the colony started to apply ethical policies in 1901, with decentralization of power as one of the main planks.[2] Under these ethical policies, it was considered that indigenous communities, with their specific characteristics, had to be involved in decision-making processes regarding development, and that, as their living conditions were significantly behind European standards, they needed external support to help them modernize (Kusno, 2000a). Spatial planning was seen as a policy field through which indigenous communities could be disciplined into compliance with modern European ideals

(Kusno, 2000b, 2010b). The city was seen as a forum for controlling these populations and imposing new orders and rationalities.

Aesthetic aspects of physical development also received more attention, and the colonial government in Batavia found other instruments besides the water works for structuring urban life: squares, monuments and public buildings with modern architecture (Blackburn, 2011; Van Roosmalen, 2002, 2005).[3] New architectural features not only marked the new modern era visually, but also forced the indigenous population to engage in certain activity patterns. For example, the traditional bazaar system that made the streets busy was not considered compatible with the image of modern urban life. The colonial government created walled markets to control the vendors and compel them to adopt modern sanitary behaviour (Kunto, 1986; Kusno, 2010b). Several monumental concrete buildings were erected to change the look of the new city centre in Weltevreden. Trees were seen as 'rural' and hence not modern (see Reid, 1980), so were cut down to enable an unobstructed view of the buildings that now formed the landmarks of the modern city (see Kusno, 2010a; Van Roosmalen, 2008). Unfortunately, colonial planners overlooked the fact that those trees played a vital ecological role in storing the ground water used by communities.

Various housing projects were launched following the introduction of modern town planning in the colony (see Harjoko, 2009; Van Roosmalen, 2005). The garden city movement influenced Batavia and design proposals from prominent Dutch architects in the South advocated the needs of the elite for better housing in better environment (see Van Roosmalen, 2008). New houses, like those in Menteng (see Figure 3), became the first target for piped water network expansion (see Kooy, 2008). Designed as a garden city, a satellite town in Kebayoran was developed in 1948 by destroying a real garden consisting of thousands of fruit trees owned by communities (Gunawan, 2010; Harjoko, 2009). It was equipped with covered drainage networks for both storm water and wastewater, but no wastewater treatment system (Gunawan, 2010). In this case, it is clear that destruction was not balanced out by equal efforts to ensure environmental protection.

After the introduction of spatial planning in twentieth-century Batavia, the separation between working and living spaces became more visible. A zoning system was introduced, together with the construction of new (luxurious) housing clusters. A spatial order based on racial segregation was gradually replaced by one based on class, instrumentalized through the designs of urban planners (Cobban, 1992; Kusno, 2000b).

In comparison with the nineteenth century, the first half of the twentieth century saw greater rural to urban migration (Kop, 2008; Van Roosmalen, 2008; Blackburn, 2011). In addition, internal migration continued, due to evictions from urban kampungs (Van der Heiden, 1990). Although new European residents had access to formal housing, there was a considerable lack of affordable housing for Indonesians. Urban kampungs provided the only option. However, the long crises of the 1930s meant that kampungs no longer catered to Indonesian populations only; they also housed poor Eurasians who could not afford formal housing (Ingleson, 2012).

The presence of taps inside the modern houses occupied by Europeans became a conspicuous consumption norm that enhanced social stratification (Saunders, 1984). Individual access to water also supported European personal hygiene practices. Contrary to the old Javanese tradition of bathing collectively in

common areas, the Europeans bathed privately, in a personal bathroom. European bathing practices were adopted by Javanese elites, especially after modern housing had been introduced and soap was massively advertised in newspapers during the second half of the nineteenth century. The Europeans considered soap to be a marker of civilization; although the Javanese, Malays, Indians and other indigenous Indonesian communities bathed much more frequently, they had not previously used soap. The Europeans also introduced indigenous communities to other new habits: changing clothes regularly, washing clothes with soap and regular house cleaning. Asian bathing traditions were undermined by conceding that, although Asian bodies may be clean, their clothes and living environments were not (Van Dijk, 2011).

As argued by some scholars (Headrick, 1988; Kaika & Swyngedouw, 2000; Taylor, 2011), colonial

Figure 4. Washing in Molenvliet, ca. 1936
Source: courtesy of KITLV/ Royal Netherlands Institute of Southeast Asian and Caribbean Studies

territorial occupation was accompanied by a colonization of the body; people's perceptions of cleanliness affect the way in which they relate to their body and living environment. Thus, in an effort to bolster Western superiority in the colonies, new technological devices and sanitary products, i.e. toilets, bathrooms and soaps, were introduced inseparably from the (re)production of norms and beliefs about cleanliness (Van Dijk & Taylor, 2011). Moreover, the state actively promoted several new consumption norms and further facilitated related collective provisions through state institutions and/or the market. These new sanitary behaviours created new spatial needs among Javanese elites: notably an inside bathroom or one attached to the house (Taylor, 2011; Van Dijk,

Figure 5. Washing in Molenvliet, ca. 1950
Source: courtesy of KITLV/ Royal Netherlands Institute of Southeast Asian and Caribbean Studies

2011). Changing personal hygiene behaviours gradually changed Javanese attitudes towards water; water became a personal domestic good.

However, Indonesians with a lower social status maintained the tradition of washing and bathing in public areas, along the canals and/or around public hydrants. Since the government moved the town centre to *Weltevreden* in 1810, urban life was no longer structured according to water, i.e. the canals, but according to squares and roads. Water bodies became public space for the poor only, and thus they were the first to be exposed to the calamities caused by unsanitary conditions in Batavia. **Figure 4**, **Figure 5**, and **Figure 6** show that in the twentieth century, communities still washed using

Figure 6. A contrasting view across Sociëteit De Harmonie – one of the modern buildings along Molenvliet, Weltevreden – **ca. 1900**
Source: courtesy of KITLV/ Royal Netherlands Institute of Southeast Asian and Caribbean Studies

water from the main canals along the boulevards of Batavia, despite its poor quality. This practice continued because water supplies to the kampungs were limited and/or because housing did not comprise enough interior space for these activities. Furthermore, the spread of modern religions caused public bathing to be seen as embarrassing (see Taylor, 2011), but kampung communities had no access to improved facilities.

Under the influence of ethical policies, more attention was paid to kampungs and the Kampung Verbetering initiative (kampung improvement) was launched. It aimed to improve roads, pathways and drainage. As in industrialized European cities in the early twentieth century (Gandy, 1999, 2004; Melosi, 2000; Porter, 1994), experts, mainly planners and sanitarians, advocated the need to improve the sanitary conditions of workers' living space in Batavia and the East Indies (Blackburn, 2011; Van Roosmalen, 2008). There were three main reasons why the colonial government was willing to improve kampungs. *First*, nationalist and socialist members of the city council urged improvement of living conditions for non-Europeans (Blackburn, 2011). *Second*, kampungs were growing extensively in between European-occupied areas, and constituted a potential source of water-borne diseases. *Third*, kampungs were seen as the enclaves of resistance and struggle against colonial rule (Kusno, 2000b, 2010b). The municipality was forced to abolish the autonomous status of the village and, in many cases, the improvement programme was implemented on the condition that kampungs renounced their autonomy (see Reerink, 2011).

To ensure the success of its *verbetering* initiative, the city council got political and financial assistance from the national government to buy and manage land previously owned by indigenous communities; the government was not allowed to appropriate community land before kampungs were included within the municipality jurisdiction (Blackburn, 2011; Niessen, 1999). However, much of this state-acquired land was then used for European residences (Blackburn, 2011) built by private firms who were invited by the government to participate in housing development (see Harjoko, 2009; Van Roosmalen, 2005). After several protests from many Indonesian activists, a programme of public housing for the poor was launched. However, this programme was not successful in meeting the needs of target groups, because house prices remained too high (Blackburn, 2011). In addition, in 1918, the government built 100 public bathing places and 15 public washing points in the kampungs (see Kop, 2008). However, this provision was insufficient to meet overall demand for clean water in the kampungs.

4. POSTCOLONIAL URBAN DEVELOPMENT

The tradition of using spatial planning to structure urban life continued after independence. During the Sukarno's *Orde Lama* (1945-66), new squares and iconic buildings were constructed to symbolize the new modern era. Several monumental sculptures were erected in public space to reinforce public consciousness of a unified awakening nation (Kusno, 2000a, 2010a). **Figure 7** shows the spatial development projects proposed during the *Orde Lama* regime. These included a new boulevard that extended the old North-South axis from Old Batavia to *Weltevreden*. The new road connected both *Lapangan Merdeka* and the satellite town of *Kebayoran* with the *Semanggi* flyover interchange located between them. The

KAMPUNGS

THE COLONIAL CITY 1619-1945

A. The Old Town, 17th C

B. *Weltevreden*, 19th C

C. *Menteng* (1920s - 600 Ha), most of the evicted communities moved to the adjacent area, Tanah Abang

POST-INDEPENDENCE DEVELOPMENT (1945-65)

1. The first airport *Kemayoran*
2. Planned housing area *Grogol*
3. Satellite town *Kebayoran Baru* (1948-730 Ha), evicted the existing kampungs, fruit plantations and farms
4. GBK Sports Complex, the Parliemet Building and other governmental functions in *Senayan* (1960), evicted thousands of people. Most of the community members moved to area around *Tebet*.
5. Planned housing area *Tebet*
6. Public buildings and university
7. Planned housing area *Rawamangun*
8. Industries and warehouses
9. Industries and warehouses

DEVELOPMENT PROPOSALS MADE IN 1965

10. Satellite town *Pulo Mas*, originally was planned (1962-270 Ha) to be a high-density settlement for low-income groups, but built (from 1966 onwards) with low density for higher income families
11. Planned housing estate *Kayu Putih*
12. Planned housing estate *Cempaka Putih*
13. Offices and commerce
14. Water front developments (luxurious landed houses, amusement park and commercial buildings)

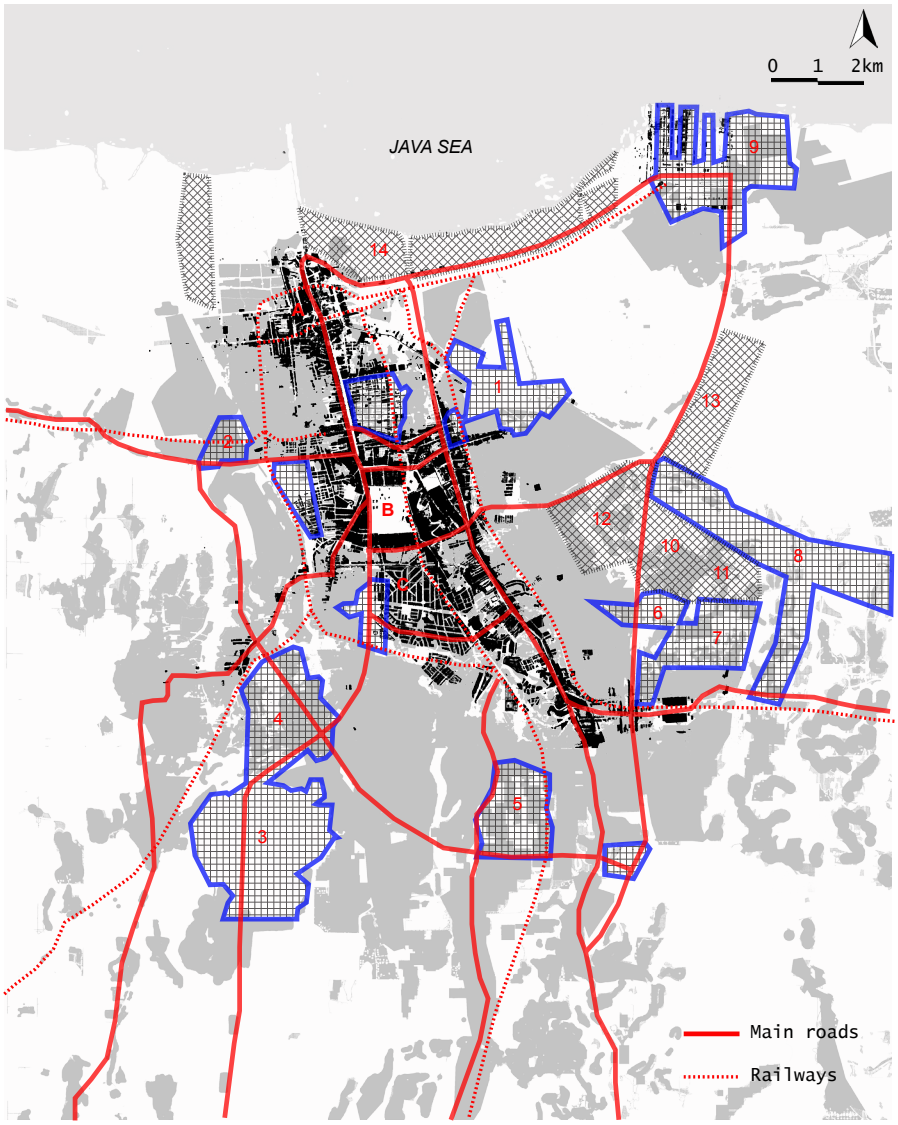

Figure 7. Jakarta 1965: existing spatial development and new development proposals

Source: compiled and redrawn by the author based on the study by Harjoko (2009) and Van Roosmalen (2005), as well as Jakarta Master Plan 1965, Batavia 1897 & 1935 (KIT collections,, the Netherlands), Batavia 1959 (US Army Map Service collection)

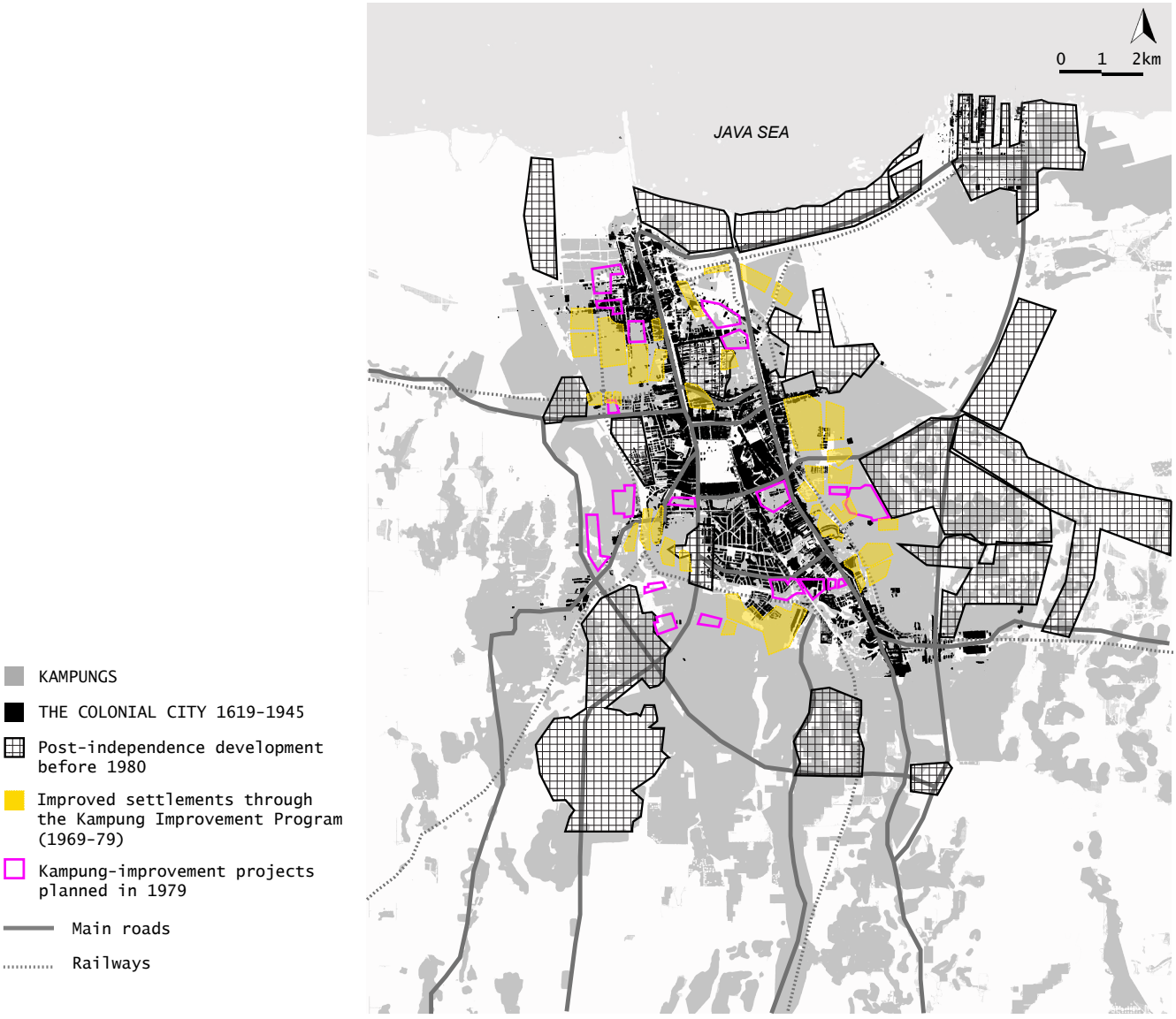

Figure 8. Improved kampungs by the (colonial) state and post-independence development before 1980

Source: redrawn by the author based on 'improved kampungs and kampungs to be improved in Jakarta' (Verschure, 1979)

spatial development approach continued promoting road-orientated physical development. New monuments and big buildings were constructed to symbolize the new modern world. Several monumental sculptures were erected in public areas, to reinforce public consciousness of a unified awakening nation (Kusno, 2000a, 2010a)

Evers (2011) argues that, during the post-independence era, Jakarta developed with a weak concept of urbanism and without strong urban institutions to provide basic infrastructures for all. He calls this approach to spatial development 'virtual urbanism', within which the government focuses on heroic monuments and large public buildings, to hide the harsh reality of an unmanaged urban population explosion, uncontrolled sprawls and poor living conditions in kampungs (Ibid., 2011).

Sukarno's nationalist regime avoided reinterpreting the 'original' characteristics of place-making in the Archipelago, despite its efforts to obliterate the collective memories associated with colonialism. *Orde Lama* continued the late colonial era traditions of celebrating collective consciousness in public squares. Indeed, Sukarno's administration chose to further the development of what had been conceived as modern before independence, instead of, for instance, leveraging traditional expertise as regards dealing with water collectively, be it for agriculture, navigation or creating spiritual symbolizations (see Boomgaard, 2007). Furthermore, many communities in the remaining kampungs were evicted to make room for the development of new civic buildings and public spaces (see Blackburn, 2011; Harjoko, 2009; Van Roosmalen, 2005). No significant efforts were made to improve living conditions in kampungs, as most of the available budget went to large-scale construction projects.

Despite neglecting and evicting kampung communities, the government produced several social housing plans (Roosmalen, 2008) (see Figure 7). Possibly influenced by socialists and communists, the government pursued a utopia of turning all of the kampungs into formally planned settlements. Not all proposals were implemented and, for the most part, those that were did not benefit poor communities (see Harjoko, 2009; Gunawan, 2010). For example, the planned housing area in *Tebet* was intended for communities evicted from the site that now houses the *Senayan* national sport complex, built in 1960 (Harjoko, 2009). Ironically, the *Senayan* kampungs had been improved during the colonial *Kampung Verbetering* initiative. Today, many parts of *Tebet* have been used to build commercial facilities and middle class housing, as a result of the urban development policy applied under President Suharto period and his *Orde Baru*. Originally, Dutch planners had earmarked the land in Tebet for a green belt and water retention area (Gunawan, 2010).

The kampungs received no further attention from policy makers during *Orde Baru* (1966-1999), the militaristic regime that followed *Orde Lama* (see **Figure 8**). The Kampung Improvement Program (hereafter KIP) was launched in 1969 by the Jakarta Administrative Government and maintained until 1978. It managed to improve 5,743 hectares of land and benefited 2.4 million people (see Bianpoen, 2011). In 1974-1982, the national government extended the programme to other cities, with support from the World Bank. By 1979, KIP had benefited about 3.3 million Jakarta residents, representing over 70 per cent of the city's estimated slum population (Werlin, 1999).

However, KIP failed to sustain communities in the kampungs (see also Werlin, 1999). Indeed, it failed to offer any solutions to underlying structural problems regarding access to land and housing. By the end of 1979,

the total area covered by kampungs that were cleared to make way for post-independence development projects was larger than the total area covered by kampungs that were improved under KIP (see Figure 8). Like in the colonial era, KIP had unexpected impacts; for example, the price of land in the improved kampungs increased. In consequence, many landowners sold their land or increased the rent, which forced many tenants to move to other kampungs (Blackburn, 2011).

The Suharto government adopted neoliberal economic strategies that facilitated foreign investment by Suharto's cronies. During his rule, there was an important urban restructuring process following the fall in oil prices in 1982; this caused investment to shift to property development and amenities for growing middle-income groups (Firman, 2002, pp. 34-35; Goldblum & Wong, 2000; Rimmer & Dick, 2009). Under the administration of Governor Wiyogo (1987-1992), Jakarta's Central Business District was expanded massively (Goldblum & Wong, 2000; Harjoko, 2009). Jakarta became a financial and service centre, while many industrial manufacturing activities were pushed to the outskirts and countryside. Both in inner and peripheral areas of the city, many residential areas, including kampungs, rapidly developed into commercial, office and condominium districts (Firman, 2002; Goldblum & Wong, 2000).

Mega-scale construction projects meant that kampung evictions were even more frequent. For example, urban restructuring processes in the late 1980s affected Kuningan and Kebon Kacang, kampungs that had benefited from KIP under the Orde Baru. While it was relatively easy to relocate to nearby sites in the 1960s and 1970s, communities displaced in later decades had to move to the outskirts, where developers of new private housing and industrial estates were also aggressively grabbing land (Goldblum & Wong, 2000; Hudalah & Firman, 2012).

Sprawl had become unavoidable. The border between the urban centre of Jakarta and its rural outskirts became blurred as many new housing and industrial estates grew up on the urban fringes (Hudalah & Firman, 2012; Leaf, 1996). The Suharto administration directed public sector spending to large infrastructure projects, especially inter-city toll roads across administrative boundaries that link several economic centres (Goldblum & Wong, 2000). This new asphalt network supported a new mobility pattern based on private cars, because the public transport infrastructure was insufficient. The automobile culture encouraged developers to speculate and build housing estates in remote agricultural areas where land was much cheaper (Hudalah & Firman, 2012).

Sprawl in the late 1980s resembled that of the late eighteenth century, when the colonial city began to expand significantly, far across its former boundaries. However, the scale of the late twentieth century expansion was much greater. Expansion, or legalized sprawl, had characterized spatial development in Indonesia since the colonial era. Densifying settlement without moving the original inhabitants out had never been an option for meeting housing needs. Instead, the state facilitated the urban expansion with exclusive solutions to improve living conditions for the wealthier people, without initiating any significant efforts to mitigate existing environmental problems. This pattern of spatial development and evictions has continued to this day (Harjoko, 2009; Sheppard & Mohamed, 2006; Simone, 2012; URDI & Mercy Corps, 2008).

To enhance the economic and spatial development strategies of Orde Baru, Governor Wiyogo (1987-1992) launched the slogan 'BMW', promoting Jakarta as *Bersih*

Manusiawi berWibawa (Clean, Humane, Respectable). The slogan was associated with an image of Jakarta that was intended to attract foreign investment and the 'BMW class', as well as an alliance between politicians, the strong executive, and the business community (Leaf, 1996). During Orde Baru, modern living was also associated with consumption patterns like those espoused by American suburban lifestyles: cars, single-family landed houses and shopping malls. The use of the term 'Humane' in the slogan can be understood as an effort to build an image of socio-political stability and equity that did not actually reflect the truth, considering the social unrest caused by evictions. The 'Clean' image had actually been developed earlier by Suharto, to promote a nation that was free of the communist ideology that grew during Sukarno's rule (Kusno, 2006). The terminology was also used to create an impression of a new modern Jakarta, with clean streets and no street vendors or *becak* (three-wheeled rickshaw). The latter was seen as traditional transport, associated with rural areas; it was not considered 'humane' because it was a human-powered vehicle.

The militaristic Suharto regime also introduced the concept of security, placing guards in commercial and business districts to show that Jakarta was a place of order. Residents were expected to behave in a disciplined manner in the public (consumptive) space that had been created inside buildings (e.g. shopping malls), instead of in the open public spaces associated with Sukarno and the people's movements (see Kusno, 2006, 2010a, 2010b). Indoor 'public' space could protect those who can pay from pollutants outside. At the same time, canals along the main boulevards were no longer used for washing and bathing, as the kampungs disappeared from the inner city and strict regulations were enforced to keep the main districts free from the activities of the poor.

4.1 Individualization of Sanitation Development

During *Orde Baru*, the national government implemented various sanitation initiatives, but the development budget allocated to this domain was very small. A national health infrastructure development programme was launched through Presidential Instruction No. 5/1974. The programme included an annual project named SAMIJAGA (*Sarana Air Minum dan Jamban Keluarga* – Drinking Water and Latrines for Households), which aimed to build communal drinking water facilities and individual latrines. Through the latrine project, the government promoted open-defecation-free environments. However, in the first year, it financed only 150,000 latrine units across Indonesia, for a total population of almost 120 million (Presidential Instruction No. 5/1974).

Beyond the household-level sanitation development programme, little attention was paid to environmental sanitation issues at neighbourhood and city levels. The Kampung Improvement Program (KIP) was meant to improve sanitary conditions in the kampungs, but it did not include any plans for developing wastewater management systems at neighbourhood level. The focus was mainly on improving road access and drainage, which can only transport away untreated wastewater.

The market-oriented spatial development strategy adopted by *Orde Baru* not only harmed the existing social fabric of urban and rural kampungs in and around Jakarta, but also adversely affected the overall quality of the urban environment. Road-oriented urban expansion to the south used land that had originally been set aside for groundwater recharge and community agricultural land, and coastal areas deteriorated even faster. Many Jakarta

residents are increasingly unaware that they live in a coastal lowland area, and that water-related problems are therefore crucial issues. The Suharto regime continued transforming wetlands to develop Jakarta's coastal area into luxurious housing, industrial and leisure estates. Coastal land reclamation and commercialization for exclusive water-front development have blocked public access to the sea. This spatial development strategy has also caused the consciousness of Jakarta residents to shift away from the water.

Today, Jakarta's centralized sewerage system only covers two per cent of the city area. Surprisingly, the government has been granting developers the right to build housing estates without forcing them to provide proper environmental management systems. In short, post-colonial governments have failed to consider urban environmental sanitation as a primary public sector concern. Sanitation has been treated as an individual need only, and has been left to the responsibility of individual households.

5. THE PERSISTENCE OF KAMPUNGS AND A POTENTIAL APPROACH OF SANITATION DEVELOPMENT

Although mega construction projects have displaced many communities, contemporary Jakarta is marked by the persistence of its kampungs. The previous sections show that (colonial) state-led city expansions were always accompanied by the emergence of new kampungs or the densification and growth of existing ones. Indeed, economic growth in Jakarta continually fuelled a strong demand for cheap labour. In addition to being subject to eviction, kampung communities have been forced to enter low-cost labour markets (see also Simone, 2012). These proletarization processes are inseparable from the changing relationship between communities and their (agricultural) lands, both in urban and rural areas. Influenced by the trajectories of state-led development strategies, urban kampungs are the socio-spatial product of active community-driven processes by which low-income populations find affordable solutions for accessing housing and food while maintaining jobs in the city.

Both blue-collar employees and informal sector workers live in Jakarta's kampungs. Furthermore, kampungs have always been home to seasonal workers and circular migrants, with so-called permanent residents probably accounting for only half of the population (see Ingleson, 1988, 2001; Mulyana, 2012). Since their emergence during the colonial era, urban kampungs have been home to a population with multiple income structures. In 1925, labourers, clerical staff and informal sector workers (vendors, maids, petty peasants, farm workers, etc.) formed more than 80 per cent of the population, and generally had the lowest level of income (see Booth, 1988). Today, approximately four million Jakarta residents hold formal jobs, while around half a million members of the labour force are unemployed (BPS, 2010). Nearly 60 per cent of those who are formally employed have a staff position, and around 75 per cent of them work in the service sector, finance and banking (Ibid., 2010). It is estimated that, from 2005 to 2010, around 27 per cent of the labour force, or around two million people, were informally employed (Mulyana, 2012). In many kampungs, informal and casual employment rates are much higher than city-wide statistics would suggest (URDI & Mercy Corps, 2008).

However, the long-standing absence of a proper sanitation infrastructure in Jakarta has combined with aggressive spatial development practices to worsen contemporary living conditions in the kampungs. General living costs have increased and the settlements of the urban poor have become more prone to the calamities caused by environmental degradation (Steinberg, 2007; Texier, 2008). The environmental sanitary condition of urban kampungs today is a legacy of the exclusion of traditional settlements from the modern infrastructure planning system since its inception.

Towards the end of the nineteenth century, the colonial state began to organize water and sanitation service provision using modern technologies. When the state started organizing the water and sanitation infrastructure, the city's water supply became what could be called a *quasi-social good,* in that it was delivered by the state with subsidies. However, the supply system developed by the colonial state was unable to serve all or ensure equity. The practice of providing water and sanitation infrastructure services exclusively for small population groups has continued in the postcolonial era.

Not only has no significant effort been made to build a basic infrastructure for providing services to poor urban communities, but the urban poor have long faced continuous threats of eviction. Throughout the different regimes, the state has subjected the kampungs to various degrees of conflictive institutionalization processes. Kampungs were seen as needing to be brought under control and integrated into the city's wider socio-spatial arrangement; certain ideals could be imposed upon them, but at the same time they were deemed to be underdeveloped sites that needed to be removed from the modern urban landscape and replaced by buildings and amenities for accommodating profitable economic activities. In the absence of welfare policies, kampung communities are not treated as united entities with certain rights, but as groups of self-responsible individuals (see Simone, 2010). In this way, households are the passive agents of consumption (see McFarlane, 2008b). Under *Orde Baru*, spatial development strategies made cities into sites of consumption in which many communities have become increasingly vulnerable compared with the more powerful development actors.

The previous sections indicate that governments have used both spatial planning policies and water infrastructure development strategies as an effective tool for supporting the economy and sustaining a subservient society as a non-demanding formal and informal labour pool. The state has occasionally facilitated spatial development, mainly to support economic activity and accommodate the needs of particular population groups with a priority position within the economic productive sphere. Recent neoliberal strategies have increased discrepancies between formally developed urban enclaves and kampungs. Over a century after modern spatial planning was first introduced into Indonesia, environmental sanitation management still fails to respond to the specific biophysical characteristics of an urban agglomeration in a coastal area, account taken of the various intertwining historical trajectories of socio-political and economic systems.

Today, communities are still far from able to solve their environmental problems, because of inaccessible costs, lack of capability to organize the necessary collective actions, and inadequate state protection of community reciprocity networks (Douglass, 1992; McGranahan, 1993; Simone, 2010). Mechanisms that kampung community members once used to face crises collectively have now been lost, and their territorially-

embedded socio-ecological institutions have been disrupted. In the pre-modern era, communities had some degree of autonomy for organizing their productive landscape. Within traditional agricultural communities, water was considered to be both a common productive good and an element of the ecosystem that was vital for the (re)production of the society. Certain traditions, inherited from agricultural society, are still applied in many kampungs, like discharging wastewater into open water bodies and using river water for washing, although the quality of river water does not meet health standards.

Given their extensive heterogeneity and temporality, today's kampung inhabitants may not have the level of cohesiveness necessary to create collective community systems for providing water and sanitary infrastructures in the absence of state-led provision. What could structure such cohesiveness, in the absence of any agricultural activities to bring community members together as a united productive and reproductive entity? There is no easy answer to this question. It seems that contemporary urban kampungs have no mechanism for facing crises collectively. Every household deploys its own individual survival strategies, anticipating and adjusting to the dynamics of the big actors (e.g. overly powerful developers, non-democratic local government, greedy tenants and/or landlords, etc.), while striving to satisfy their basic daily needs with their limited means of income. Faced with numerous uncertainties, no least the fact that the state cannot even guarantee the on-going presence of kampungs in the city, it seems impossible to expect kampung inhabitants to produce their own (waste) water management systems, especially as this would require relatively long-term commitments from territory-based communities.

Communities have been managing their environments to meet basic sanitation needs, provide clean water and deal with waste, although these have functioned as short-term solutions and with diminished quality. It may be argued that one way to strengthen collective community efforts would be to link the dispersed kampung enclaves throughout Jakarta as a recognized urban spatial entity, equal to other spatial planning units, such as commercial or industrial districts and formal housing. A universal right to water and sanitation does not necessarily require a uniform way of providing and accessing the services. As there will always be 'a multiplicity of population groups', it is only logical to draw on 'multiple and flexible policies' that leverage 'multiple techniques of administration' that can be tailored to different characteristics of territorialized communities (Chatterjee, 2004, pp. 36, 136).

There have been calls for research to find ways of working towards better systems of community self-management, both for meeting basic household water and sanitation needs and for managing the local environment and resources (see Douglass, 1992). It has been strongly argued that policy makers should see communities as groups of active citizens who are able to design and control their own service provisions (Allen et al., 2006; Parra, 2013), and neighbourhoods as sites for coordinating and deploying collective action for urban improvement (see Simone, 2010). And if the state expects communities to provide solutions for their environmental problems, it must protect their re-productive socio-economic activities.

This article does not go into sufficient detail about everyday kampung neighbourhood dynamics in contemporary Jakarta. Nevertheless, comparing the colonial and post-colonial situations helps understand the transformation of modern state institutions and their role

in facilitating the collective efforts of particular population groups to improve the sanitary condition of their living environments. Such comparison is an effective means of revealing governmental dynamics, involving changes of political elites and their different policy orientations, as well as the ways in which these dynamics have impacted communities in the kampungs. Further research would examine daily power relations in kampungs, which are structured by other rationalities beyond the modern formal institutions.

NOTES

1 Water engineering was more widely developed in the Netherlands than in other parts of Europe, thus water works supported Dutch superiority among European colonisers in the South (Brummelhuis, 2005; Ravesteijn and Kop, 2008).

2 To channel political aspirations from different groups and also to cool down the nationalist sentiment among the Indonesians, Local Councils and other local governmental bodies were formed following the Decentralization Act (Blackburn, 2011; Niessen, 1999; Van Roosmalen, 2008). Each city council was responsible for allocating its own development budgets (Blackburn, 2011), including for spatial development.

3 New development work was financed by an economy based on a state monopoly over sugar, coffee and spice trade, and later, the forced agricultural cultivation system in Java (1830-1870) (see Van der Heiden, 1990).

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III.

MULTI-SCALAR GOVERNANCE OF ENVIRONMENTAL SANITATION

CONSIDERING DECENTRALIZED WASTEWATER MANAGEMENT IN JAKARTA *

Abstract

State-led and market-oriented approaches to sanitation development in Jakarta have favoured the construction of large-scale centralized sewerage systems. This approach is not always suitable, because the principles of modern infrastructure that underlie technological systems are not applicable to the informal settlements scattered over the metropolis. Due to spatial fragmentation within the built environment, diverse socio-economic and fragile geo-ecological conditions in different settlements and the city as a whole, Jakarta needs to adopt a decentralized approach to wastewater management. This paper examines governmental dynamics in Jakarta. The discussion also refers to the case of Bangkok's decentralized wastewater treatment systems. Further, this paper analyses two inter-related neighbourhood-level sanitation projects that introduced a technology of improved septic tanks and initiated community sludge-hauling enterprises. Certainly, the presence of (international) NGOs and civil society organizations is vital, to help communities enrich their technical knowledge of environmental problems. Nevertheless, local initiatives provide a limited response to community sanitation needs and the overall sanitation problems beyond the neighbourhood level. This paper argues that the application of decentralized sanitation systems necessitates a new-form of state-led infrastructure provision that involves the (transformative) participation of local actors. Hence, it extends the notion of decentralized wastewater management beyond purely technological concerns.

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1. INTRODUCTION

This paper considers three urgent planning and development process issues that affect the sanitation sector in cities of the Global South. *First*, the state has not responded properly to various sanitation problems within the heterogeneous urban environment. Improving poor sanitary conditions in informal settlements requires different strategies from those adopted in formal planning processes for housing estates and business districts (see Bakker et al., 2008; Gerlach & Franceys, 2010; Mc Garry, 1977; McGranahan, 1993; Parkinson & Tayler, 2003). *Second*, the environmental sanitation problems have been treated as if household sanitary needs are disconnected from the whole city and river basin systems (McGranahan, 1993; Novotny, 2009; Parkinson & Tayler, 2003; Suriyachan et al., 2012); hence, they have been addressed through fragmented development programs. *Third*, alone, neither the state nor the private sector can provide basic sanitation services for all (Bakker et al., 2008; Ostrom, 1997). However, involving various actors in sanitation service provision, including the communities themselves, requires national and local governments to act as strong regulators, which is often not the case in countries of the Global South. This paper contributes to the study of environmental sanitation development processes in megacities of the Global South by focusing on these three critical issues as they have materialized in Jakarta.

This paper comprises three main sections. Following this introduction, **section two** presents the general trajectory of urban sanitation development in the Global South. To a certain extent, capitalistic regularization agendas have influenced the application of centralized water and wastewater provision systems by both state and private operators. This section shows why, in principle, this provision model has failed to provide basic sanitation infrastructures for all residents. As alternatives, many governments have begun to endorse small-scale, low-cost wastewater infrastructure systems, which also increase the involvement of actors outside the state and established private companies as providers of improved sanitation services. However, many fundamental problems remain.

Section three explores the environmental sanitation development processes and institutional dynamics that have favoured centralized wastewater management in Jakarta, involving capital-intensive technologies, i.e. large-scale sewerage networks and large

wastewater treatment plants. This section refers to the example of Bangkok's decentralized wastewater management, to show how another metropolis has dealt with problems in the urban wastewater sector. Considering Jakarta, certain institutional reforms, involving different governmental agencies, are needed before a decentralized wastewater management system can meet the city's various environmental sanitation problems.

Section four enriches our discussions with a perspective from one of Jakarta's kampungs[1], to give an insight into 'local' community dynamics in sanitation sector development. It discusses the governance of a prospective decentralized wastewater management system in Kampung Kojan, *Kalideres Subdistrict*, North Jakarta Municipality. Mercy Corps, an international NGO, has overseen a sanitation development programme in this kampung. This section points out the constraints that affect local initiatives, and the importance of state involvement to enhance the roles and capacity of local actors.

The analyses developed in this paper are based on data obtained from previous and existing planning documents. From May to December 2011, the author conducted fieldwork in Kampung Kojan and interviewed 16 beneficiaries of the program, their household members (including the tenants of benefited landlords) as well as some local leaders. Beyond the kampung level, several interviews were conducted between August 2010 and October 2012, with higher officers and field staff from Mercy Corps as well as those from national, provincial and municipal agencies. This paper also examines the role of some of the civil society organizations involved in urban and/or community development processes through activities that contribute to environmental sanitation development. The interview information used to support the arguments in this paper is explained in endnotes.

2. URBAN SANITATION GOVERNANCE IN THE GLOBAL SOUTH: SEARCHING FOR ALTERNATIVES

2.1. Fulfilling the Basic Needs

It is undeniable that everyone needs water and sanitation services. Easy and safe access to clean water and sanitation infrastructures are necessary to improve and maintain the economic and social conditions of all households. Water is crucial for domestic needs, the agriculture sector, industrial use, and the sustainability of ecological systems (Motta & Moreira, 2006; Silva, 2000). There is a fundamental challenge to ensure the continuity of water supply to satisfy all needs while the world's clean water supply is finite, as natural scientists have shown (see Barlow, 2001). In a situation of limited water sources, wastewater has to be reclaimed or at least treated for not harming surface water bodies from which most of the clean water is produced (McGranahan, 1993). Likewise, wastewater has to be managed to protect the community's health, and the environmental sanitary condition has to be maintained not only for social comforts but also to keep the viability of the whole ecological system (Barlow, 2001).

This paper defines 'governance' as a broad arena in which diverse institutional dynamics of organizing societies and ecosystems take place, including different ways of providing water and controlling sanitary conditions (see Ostrom, 1997; Ostrom, 2005). Several communities have been self-managing their access to water and dealing with their waste for centuries, allowing individuals and groups to benefit from the community's networks of natural resource systems (see Lansing, 1987 for an example of community-managed ecological networks). However, there are certain factors that (potentially) change the existing (traditional) institutional settings and limit the capabilities of each community system to sustain its resources and their utilizations (Ostrom, 1997).

In contemporary urban settings, the diversity of water and sanitation service systems does not lead by itself to more equity. Along with the market-oriented development agendas, the state facilitates infrastructure projects to serve better-off consumers and areas with key economic activities, favouring standardized modern technologies and institutions (Bakker et al., 2008; Hardoy & Schusterman, 2000; Kooy & Bakker, 2008; Parkinson & Tayler, 2003). Many small-scale initiatives through several NGOs and local entrepreneurs have offered (partial and temporal) solutions to meet different needs of basic water and sanitation infrastructures that are not met by the market-oriented provision system (see Burra et al., 2003; Hardoy et al., 2005; Hasan & Khan, 1999; Solo, 1999; Wegelin-Schuringa & Kodo, 1997). There are also communities who refuse to connect to the state water and sanitation services and find other, sometimes better, services (see Bakker et al., 2008; Conan, 2004). Meanwhile, many other communities have been excluded from the major provision systems and live without access to alternative water and sanitation infrastructure services. They, instead, perform survival strategies that harm the environment and their own health (McGranahan, 1993).

In principle, managing the sanitary condition of a neighbourhood and fulfilling the sanitation needs of a household cannot rely on individual efforts. A family cannot protect its members from insanitary practices of neighbours and/or ensure the continuity of water provision

in the house while the traditional water sources are highly polluted and the price of bottled water in the market keeps increasing. Hence, the basic sanitation needs to be organized collectively at certain scales. The following two sub-sections discuss a typical model from highly industrialized countries applied in cities of the Global South that highly relies on the state and/or the market to provide basic water and sanitation needs.

2.2. Capitalist Regularization Processes in the Sanitation Sector

The capitalistic economic and social (re-)production system is crisis-prone due to potential conflicts caused by such a system that rests on a suffocating economic growth dynamics and a market-mediated accumulation system (Swyngedouw & Jessop, 2006). Thus, sustaining economic and social (re-)production requires a broad range of regularization or normalization processes (Ibid., 2006). These do not only include industry regulatory frameworks, but also associative regulatory processes that maintain the coherence of the economic and the extra-economic sphere for uninterrupted (re) production processes (Mingione, 1991). Along with the development of capitalist (re)production system, several compatible social cultural political practices have been institutionalized mainly involving the state (see Jessop, 1996; Mingione, 1991; Swyngedouw & Jessop, 2006).

Cities have become important spatial nodes for the capitalist economic and social (re)production system. They have been the scenes of transformations resulting from the interplays between efforts to support, resist or oppose to market-oriented developments (Graham, 2000; Harvey, 1985, 2005; Simone, 2010). The state regulates urban socio-ecological transformation processes through, among others, the development of several infrastructure sectors (Gandy, 2004; Graham, 2000; Melosi, 2000; Moulaert & Jessop, 2013; Porter, 1994).

The development of infrastructure such as water and sewerage networks has become a norm to measure economic growth, and also to legitimize the ruling regime (see Kaika & Swyngedouw, 2000). Meeting the people's basic needs, including water and sanitation, would ensure the productivity of workers and the growth of manufacturing and other industries, as well as improve the incomes, reduce health costs and increase consumption (Araral et al., 2011). In theory, or ideologically speaking, the capitalist regulatory framework is designed to support equal access of water and sanitation for all, since this condition likely can promote cohesion and endorse a stable political environment for successful economic development (Ibid., 2011). But, the market-oriented policy frameworks for water supply and sanitation infrastructure provision systems adhere to two contradictory principles, efficiency and equity, which is discussed below.

2.3. Efficiency and Equity: Two Contradictory Sides of the Policy Framework

Within the capitalist regulation framework, the finite nature of water resources has led to a concept of water as an 'economic good', but an efficient state management system has to be in place to protect individual rights to water if not misallocation occurs (see Ostrom, 1997). Big urban agglomerations consume big volumes of water and produce plenty of wastewater to which the state and corporates have responded by developing large-scale technological systems to deal with scarcity and pollution. It is argued that economies of scales can be reached within such systems (Bakker, 2003; Gerlach & Franceys,

2010; Ostrom, 1996). In fact, the centralized sewerage and potable water infrastructure models are capital intensive - requiring continuous big funding for their construction, operation and maintenance - while recovery of investment costs is generally very poor (Bakker, 2003; Gerlach & Franceys, 2010; Parkinson & Tayler, 2003). A slow recovery of investment costs gives legitimation to the state for organizing long-term (investment) planning and (subsidized) water and sanitation service provisions (Bakker, 2003; Ostrom, 1996; Whittington et al., 2012).

In many industrialized countries, the idea that the state is the key actor to ensure the pace of infrastructure development and universal access to water and sanitation services has eroded (Graham, 2000). Metropolises of the Global South have been far from reaching the ideal condition of universal access; the state and its institutions facilitate capitalistic development agendas (Jessop, 1996), without having effective programs to meet the basic needs and to alleviate poverty (Whittington et al., 2012). However, the principle to collectively organize water and sanitation service provisions is maintained and has been reformulated (see Araral et al., 2011; Gerlach & Franceys, 2010). While subsidies have been reduced or even stopped, involvement of the private sector to invest in the sector is legitimized for the sake of improved governance. The industrialization (i.e. mass-production and collective organization) of water and sanitation infrastructure provisions in the Global South that started in the 1980's, in fact, has been inseparable from the commercialization of the services and privatization or corporatization of state utilities (see Bakker, 2003; Dagdeviren, 2008). The involvement of the private sector has been seen as a solution for the state's absence or incapability in providing water and sanitation services (Bakker, 2007; WSP, 2011). This private sector involvement was supported strongly by bilateral and multilateral aid agencies (Bakker, 2003; Bakker et al., 2008).

According to the privatization logic, communities are no longer conceived as groups of 'citizens' whose rights to basic sanitation services should be met fully by the state (see Allen et al., 2006). Satisfaction of water and sanitation needs is evaluated based on customer values, even by the community members themselves; those who pay have the right to demand good services (see McFarlane, 2008). To achieve efficiency, the state needs to facilitate market competition and encourage private entities to participate in the market by offering the cheapest possible standardized water supply. However, this is impossible to achieve due to the strong and resilient network monopoly characteristics of the centralized water and sanitation infrastructure systems (see Bakker, 2003; Davis, 2005; Graham, 2002). Considering that a pipe network requires big capital investments, it has been considered as non-economical to have two or more providers operating in the same area because two or more competing pipe-networks would have to follow the same trajectory (Graham, 2002). Moreover, being capital intensive, the water and sanitation sector requires long-term planning processes, which do not suit the risk-minimization and profit-maximization priorities of private companies (Davis, 2005).

In the Global South, there are several models to deal with the unattractiveness of the water sector for private companies (for reviews see Araral et al., 2011; Braadbaart, 2005; Davis, 2005). The most common strategy is to divide the market into several service areas to have one operator for each of the operational territories. Once contracts have been awarded to the most competitive firms, however, the nature of competition erodes and the population within a certain operational territory can

only be served by a 'local' monopoly service provider (Davis, 2005; Graham, 2002). This strategy has also been applied in Jakarta. The provincial state-owned water company, PAM JAYA, has privatized the water provision through the concessions with PALYJA that serves the west part of Jakarta and AETRA that serves the east part of Jakarta. Tariffing has been an instrument within the policy framework to answer the equity challenge. But contradiction remains (see Dagdeviren, 2008). On the one hand, sufficient funds to cover the operational costs and profits for the shareholders and/or further investment (e.g. expansion of the infrastructure networks) have to be generated (Dagdeviren, 2008; Davis, 2005); but on the other hand, principles of 'affordability' and 'equity' have to be respected (Araral et al., 2011).

While the state actively facilitates the commercialization of water, the environmental sanitation sector in countries of the Global South has been neglected. The wastewater sector has weaker managerial frameworks compared to clean water supply (see Araral et al., 2011; Davis, 2005; Motta & Moreira, 2006). Who does what for the development of the sector is not clear and there has been very low commitment to improve the sanitation condition at all governmental levels (WSP, 2011). Moreover, vertically integrated policy making processes for environmental sanitation development are not in place (Araral et al., 2011). The low level of regulation in the sanitation sector can be seen as a result of its long-time neglect in the development processes. More attention to water supply is likely caused by the fact that its privatizations tend to be more successful (see for example the case of Manila and Jakarta in Argo & Laquian, 2004). In many developing countries, privatization of water supply has increased over the past two decades (Bakker et al., 2008). Clean water is a commodity that the private sector is willing to invest in because end users are willing to pay for the service (Mc Garry, 1977; Parkinson & Tayler, 2003).

2.4. Alternatives to the Standardized Technology: Ways towards More Democratic Sanitation Governance?

Substantive empirical evidence has shown failures of the market-oriented development strategy to meet the basic infrastructure needs, especially of those with the lowest income, rural communities and inhabitants of peri-urban areas (Aguilar & De Fuentes, 2007; Allen et al., 2006; Bakker, 2007; Bakker et al., 2008; Dagdeviren, 2008; Hardoy et al., 2005). Large-scale and centralized wastewater management, the standardized system promoted by the market-oriented development strategy, is not suitable for cities in developing countries that generally are vast due to uncontrolled urban sprawl and characterized by various levels of density and enclaves of non-planned settlements (see Mara & Alabaster, 2008; Parkinson & Tayler, 2003). To serve the entire city with an off-site system is not efficient, because wastewater has to be transported and pumped over a long distance to a treatment plant while clean water reclaimed from the treatment process has to be distributed to other areas to be used; and the large-scale sewerage model also requires a lot of water to flush (Medilanski et al., 2007). With the centralized piped-water and sewerage systems, it is impossible to balance the needs to consume and capabilities to produce as well as to balance the pollutants generated and efforts to clean up at the local level.

In contrast, decentralized wastewater management has a principle to handle and treat wastewater 'as close as practical to where it is generated and to where its potential

beneficial reuse is located' (Suriyachan et al., 2012) or, in other words, it allows a complete cycle of wastewater treatment processes at the local level in which all volumes of influent are treated into a safe and/or useful product. It promotes an efficient provision system in the sense that development practices of other sectors, e.g. clean water supply, agriculture, water transport, water-front public space and flood management can be taken into account while solving the problems of wastewater management. The application of alternative technologies for sanitation development has also been seen as an entry towards the reforms of the state-market-centred institutional arrangements. It has been argued that decentralized wastewater management with the application of small-scale treatment facilities can open possibilities for actors outside the central government, i.e. local governments, local NGOs and community organizations, to play greater roles (Hardoy & Schusterman, 2000; McGranahan, 1993; Solo, 1999).

Ideally, for accommodating different needs and socio-ecological contexts, infrastructure models need to be chosen based on consensus, agreed by different types of users at a certain scale instead of imposed by providers and/or regulators. We could also imagine that 'users' can also take the roles of 'providers' and 'regulators' (see Ostrom, 1996; Ostrom, 1997). 'Community involvement' has returned into the academic debates, because communities are seen as active providers of improved basic sanitation services along with the state and private enterprises (Allen et al., 2006; Ostrom, 1996), and because it is believed that they can respond to different environmental problems through the application of simpler and smaller-scale technologies (Jewitt, 2011; Mara & Alabaster, 2008; Parkinson & Tayler, 2003). However, so-called 'community involvement' for 'better governance' also fits in the strategies of neoliberal economic regimes. Even when the state, together with many NGOs and foreign institutions, has facilitated the application of smaller-scale technological systems, in many cases, households might still be the passive agents of consumption.

Hence, it is a great challenge to make the decentralization of (waste)water management as means for transformative participation, in which citizens' empowerment could take place and communities are not seen as 'clients' or 'consumers', relying on decisions of powerful others in fulfilling their basic needs (Allen et al., 2006; Hickey & Mohan, 2005). Communities should have greater controls over and distribution of their water resources as well as capabilities to link the fulfilment of sanitation needs with other basic needs. Without these principles, the so-called community-based sanitation infrastructure system will only be another form of capitalistic infrastructure service provisions that applies the market logic: who pays can get access and who cannot will be excluded, while it is assumed that everyone faces the same environmental sanitation problems and needs the same type of sanitation infrastructures (McFarlane, 2008).

It is also important to understand that 'community' is not a homogenous entity and not every layer of it might benefit from the opening rooms for participation; the middle class tends to optimize the opportunities more than the poor, who are trapped in the circle of poverty and unavailability of time for doing other than survival activities (see De Wit & Berner, 2009; Zérah, 2009). Moreover, even if the ideal socio-political condition can be achieved at the local level to implement decentralized water resource and sanitation management, higher levels of institutional frameworks are still needed. Scaling-down could lead to fragmentations and a failure to address

overall environmental problems adequately, certainly in the absence of integration processes through policies and legal frameworks at the larger scales (Luthi et al., 2008; McGranahan, 1993; Ostrom, 1996; Parkinson & Tayler, 2003). Thus, small-scale wastewater management systems using alternative technologies will not be effective in underperforming institutional settings (such as passive government agencies, unorganized citizens, and corrupt participation mechanisms) (Fritz & Vollmer, 2006; Ostrom, 1996).

3. THE ENVIRONMENTAL SANITATION SECTOR IN JAKARTA

3.1. Thirty Years of Regression: The State-Led Sanitation Infrastructure Development

DKI Jakarta (Special Capital Region of Jakarta) is populated by nine and a half million registered inhabitants[2] and part of a larger urban agglomeration called Jakarta Metropolitan Area in which approximately 27 million people live (the 2010 national census in Firman, 2011). It has a 'centralized' sewerage system that covers only approximately two per cent of its area and serves less than two per cent of its population (PDPAL Jaya, 2010; Yachiko Engineering, 2012). Apart from the sewer network there are some on-site systems organized by the state, mainly in public markets and governmental offices (see **Figure 1**). The provincial government claimed that, together with the sewers, these systems serve 15 per cent of the population (Ibid., 2010).

In the last three decades, regular governmental activities related to domestic wastewater management were confined to maintaining and operating the existing infrastructure owned by the state as shown in Figure 1. In contrast to water and sanitation, the DKI Jakarta Provincial Government[3] focuses more on solving the problems of traffic jams and floods.[4] It has been very reactive in addressing urgent matters, for example the calamities caused by floods, and managers did not have time to develop long-term solutions or explore some innovations for governing the city, because very often they had to respond to 'spontaneous' commands from the top.[5] The performance of the provincial government often lost effectiveness due to some political interests within the organizational structure, especially during periods of elections.[6]

Outside the state-led provision system, up to 2005, it was estimated that in the city, there were 1.6 million septic tanks serving individual houses (Miller, 2006). The use of septic tanks, however, does not guarantee environmental protection from domestic wastewater. A septic tank normally is used only for recovering black water containing human excreta; grey water produced from washing and bathing remains untreated before being charged into the ground and open water bodies. It can be estimated, hence, that in Jakarta, 85 per cent of grey water is discharged directly into the ground and water bodies, while around 60 per cent of black water is not treated. With the weak environmental management, and a forecast of thirteen million inhabitants in 2030 (Jakarta Master Plan 2030), Jakarta is facing a serious problem.

While informal settlements and slums have been considered as the main areas without proper sanitation infrastructure systems, actually many housing and commercial estates are not equipped with proper environmental sanitation management systems, because of the weak regulatory frameworks for property

development. The massive urban physical development, apparently, has not been accompanied by strict environmental controls for socio-ecological sustainability.

There are two main instruments regulating the development of 'large buildings' such as offices, shopping malls and apartments: land use allocation permits and building permits. One of the requirements to get the second letter of permission is that each developer of the construction project has to provide a document explaining the wastewater management system that is part of the environmental management and/or monitoring plans (UPL/UKL). In principle, if an area is served by the state sewer-trunks, any building constructed in that area has to be connected to the state system for channelling its wastewater. If not, each building has to provide another wastewater treatment system and the approved treatment system should be controlled regularly by the Regional Environmental Management Agency (*BPLHD*). However,

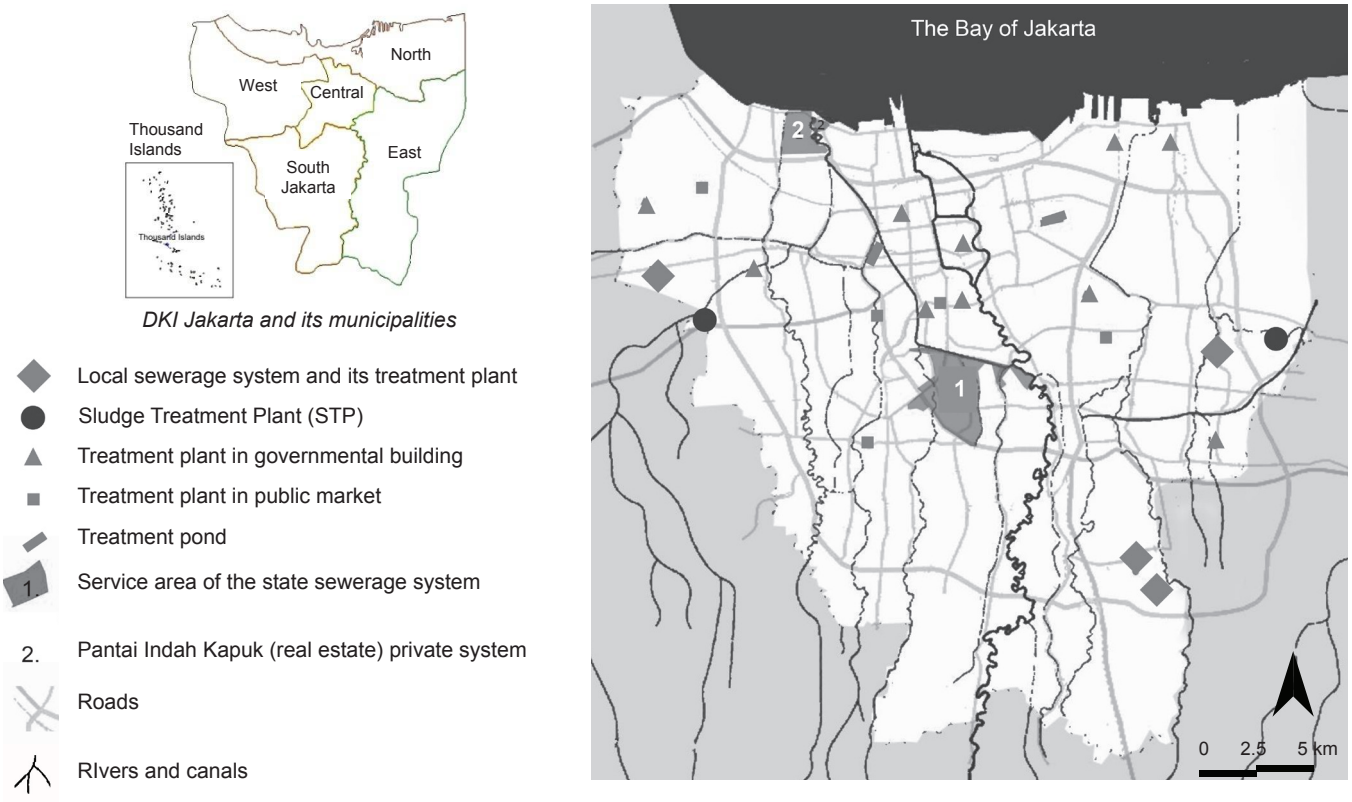

Figure 1. State-Led Developed Wastewater Infrastructures in Jakarta
Source: Redrawn by the author based data and maps from PDPAL Jaya and Miller (2006)

there has not been any specific direction for areas outside the coverage of state sewerage service, whether the treatment system should be organized individually or collectively beyond one building and what kind of treatment system should be used.[7] Unfortunately, BPLHD does not have a capacity to control the quality of various systems applied in Jakarta.[8]

Worse even, there is no proper regulation for developers of landed houses regarding the management of domestic wastewater. Building permits for these landed houses are issued individually. For the category of 'small and simple building', the developers are not obliged to provide wastewater treatment plants collectively for the housing estate areas. Normally, owners have septic tanks in their backyard; although actually it is not a suitable system for such a crowded urban setting, this practice has been considered appropriate for decades. But even with such an improper common assumption among public servants, surprisingly, having a septic tank is not part of the requirements to get the building permit.[9] In many cases the operation of a septic tank is the individual owner's responsibility and there is no quality control for the septic tanks by BPLHD.[10] *Pantai Indah Kapu*k is currently the only private housing estate in DKI Jakarta that has a collective wastewater treatment system (see Figure 1). Some others have their own piped water systems but no proper wastewater treatment systems.[11] Many housing estates drain their untreated grey water to the surrounding kampungs and water bodies. Figure 1 also shows state-developed housing estates that have relatively good drainage systems, but no local wastewater treatment system.

Jakarta's first wastewater master plan was actually developed in 1977. In this master plan, it was mentioned that both off-site (centralized) and on-site (individual or communal) wastewater treatment systems should be in place to sanitize the whole city. However, its detailed engineering plan was only developed for two sub-districts and it was merely a centralized system (PDPAL Jaya, 2010). Only a small part of the 1977 Master Plan was implemented in 1983, which is now covered by the state sewerage system (Ibid., 2010). Since 1983, the Master Plan has been revised three times (1991, 2001, and 2005). The scope of the 1991 document goes far beyond the first master plan. It studied the whole area of Jakarta and proposed more than 16,000 Ha to be covered by a centralized system (around five times the coverage area of the existing sewerage system) (JICA, 1991). The 1991 plan was not implemented. Following the failure to implement the 1991 plan, another plan was developed in 2001. The document concentrated on the previous prioritized area in the centre and proposed a smaller centralized system in the northern area. In 2005, an action plan to implement the 2001 document was made and it was followed by at least two detailed engineering plans in 2007 and 2009 (PDPAL Jaya, 2010).

Despite the efforts to produce the master plans and their related action plans, there has been no significant expansion of the sewerage networks in the last three decades; the sewerage coverage area has not even doubled after the first construction of the sewerage network in 1983. It was only in 2010, in accordance with a process to develop a new wastewater master plan, a joined investment was committed involving the Fauzi Bowo provincial administration (2007-12), the national government and some foreign agencies. The new commitment was a result of tough negotiation processes between the national government and the provincial administrative; the Ministry of Public Works (*Kementerian PU*) forced DKI Jakarta Province to invest more in the sewerage expansion project.[12] This

commitment can be seen as an improvement. In the 1990s, some disagreements between the provincial legislation body and the national government led to the cancellation of investments for sewerage expansion projects.[13] However, a closer look to the new master plan leads to a more nuanced view.

The latest master plan was initiated in 2010 and the draft was finished in 2012, with funding from the Japan International Cooperation Agency (hereafter JICA) and technical assistance from some Japanese consultancy firms. The new master Plan (hereafter *the 2012 Master Plan*)[14] observes that Jakarta cannot be served with a single centralized system. Thus, fifteen zones of sewerage networks with separate wastewater treatment plants have been proposed and these zones should be implemented in three stages of development up to 2050. It is estimated that in total, the off-site systems will cover 80 per cent of the Jakarta area while it is assumed that on-site systems will suit the other 20 per cent that consists of slums and informal settlements (Yachiko Engineering, 2012).

The new master plan (hereafter *the 2012 Master Plan*) states that it advocates local, individual or communal, systems (Basic Policy 3) and incorporates institutional aspects for sustainability of the infrastructures (Basic Policy 4) (Yachiko Engineering, 2010). However, it seems that these policies are just formalities. Following the market logic, it can be argued that dividing Jakarta into several sewerage zones would attract more investors and make their operational processes more effective. But, the master plan ignores the actual community and governmental dynamics in Jakarta.

First, it is too ambitious to propose that the sewerage networks would cover 80 per cent of the Jakarta area while around 65 per cent of the city surface is residential (see **Figure 2**). The 2012 Master Plan unreasonably assumes that communities would voluntarily connect to the new sewerage networks while necessary legal frameworks have not been in place. Moreover, within each zone, there are enclaves of slums. Strategies to incorporate these specific enclaves have not been made.

The 2012 Master Plan does recognize the existence of four types of on-site sanitation technologies, widely used by actors in the private sector - individual treatment plants (ITP) and advanced individual treatment plants (ATP) - and by communities - conventional septic tanks (including soak pits) and improved septic tanks. Therefore it is incoherent that the master plan suggests prioritizing new investments in large-scale sewerage networks instead of improving these local systems. And although the master plan realizes that the development of complete sewerage networks (the main trunks, secondary and tertiary branches) will take a relatively long period, it still suggests prioritizing the development of the main sewer trunks, thus not offering short-term solutions to the sanitation needs.

Second, there are no proposals for how to develop the 20 per cent area that has been identified suitable to have on-site sanitation systems. There are only some normative suggestions, for example, that the quality of septic tanks have to be improved, i.e. waterproof, durable, and capable to also treat grey water.

It is not realistic to expect the communities installing standardized septic tanks while the roles of the cleansing agency, *Dinas Kebersihan*, still have to be enhanced and expanded, as argued below. While PDPAL Jaya, the wastewater company, only manages the off-site system, Dinas Kerbersihan is now the only state agency dealing with on-site sanitation systems, i.e. the household septic-tanks and individual wastewater treatment plants. But the responsibility to manage on-site

sanitation systems has been a minor component in Dinas Kebersihan's activities, which mainly focus on solid waste management.[15] Moreover, the responsibility has been limited to pumping and transporting the sludge to the two dedicated end-treatment plants (Sludge Treatment Plant – STP). It now operates 121 sludge hauler trucks and regulates 67 private licensed sludge hauler trucks.

A septic tank is actually a pre-treatment technology that requires further steps: the collection and final treatment of the sludge. The implementation quality of

Figure 2. Jakarta Spatial Fragments and Its Wastewater Master Plan (Draft 2012)
Source: Redrawn by the author based on Jakarta Master Plan 2030, data and maps from Jakarta Housing Agency (Dinas Perumahan, 2008), Mercy Corps (2008), Jakarta Wastewater Master Plan Draft 2012 (Yachiko Engineering, 2012)

Box 1. The Indonesian sanitation sector and its key development programmes in the past * *

In 1985, the Integrated Urban Infrastructure Development Programme (IUIDP) was launched. Through IUIDP, for the first time in the post-independence era, environmental sanitation was seen by the national government as a development sector that had to be organized at the city-wide level. It was not anymore treated as a problem at the neighbourhood level. The programme was designed to integrate several infrastructure sector developments, to address the infrastructural needs of the whole urban system (neighbourhood and city-wide scales) and to consider longer-term needs and development processes (see also Hoff & Steinberg, 1993). The integrated development programme was designed to involve active participation of local governments, including the management of their financial resources without too much reliance on the national government (Soegijoko, 1992). It was also pushed by the growing concern for efficiency and effectiveness of (international) public investment (Mattingly & Winarso, 2000).

Led by the Ministry of Public Works, the IUIDP responded to the previous infrastructure development processes that were considered fragmented (project-oriented, not focused on long-term needs and dedicated only to particular infrastructure problems in the project areas). In the first generation of internationally funded urban sector projects in Indonesia (from 1969 to early 1980s), there was no inter-sector co-ordination (between the construction of roads, drainage, sanitation facility construction and clean water supply provisions), and urban managers did not adequately plan, for example, the location, sequences and time of construction (Mattingly & Winarso, 2000).

The IUIDP was designed as an instrument for mid-term infrastructure investment-planning at the regional (and not the national) level, accommodating the actual needs informed by the lower government levels (Hoff & Steinberg, 1993). Through the IUIDP, it was expected that foreign aid could be synergized with other sources of funding, such as national and provincial public resources so that infrastructure development could be planned over a longer term instead of for each single project. Through the IUIDP, spatial planning was used to guide urban infrastructure investment planning, not only to make the international investment efficient and effective, but also to attract private sector involvement (Op. cit., 2000).

The IUIDP included the Kampung Improvement Program (KIP), a programme to address low-quality housing conditions in kampungs. KIP was designed as an integrated programme at the neighbourhood level that addressed not only the housing conditions, but also socio-economic and environmental sanitation problems in kampungs (Bianpoen, 2011). In fact, KIP did not solve many infrastructural problems of the kampungs. Thus, it was considered that approaches beyond the neighbourhood level, like in the IUIDP, were needed (Hoff & Steinberg 1993).

Regrettably, sanitation development i.e. wastewater management had the lowest priority among all elements of IUIDP; road constructions received the biggest funding, followed by drainage, clean water provision and solid waste management. Wastewater typically received three to five per cent of the investment programmes while drainage, 20 per cent of the investment programmes (Miller, 2006). Moreover, the IUIDP was implemented in a top-down manner, relying on the power of the Ministry of Public Works, especially during the decision making processes, to select the technological and operational systems. Within the IUIDP, several urban infrastructure projects were launched including the construction of centralized sewerage systems in some large cities. The projects focused on delivering physical infrastructures rather than capacity building within local government and awareness of the importance of sanitation development amongst communities. As a consequence, affected communities did not appreciate the new physical development; the centralized

these steps is not always guaranteed. In 2006, from the 1.6 million existing septic tanks, less than one-third of the domestic black water tapped by the tanks arrived at the two STPs (Miller, 2006). This situation has not improved, as we learn from comparing the designed capacity and the actual utilization of the two STPs.[16] Many septic tanks are leaking so that the tanks will not become full even without emptying the sludge regularly.[17] Moreover, it is often found that the trucks discharge the sludge not in the dedicated STPs (see the location of the two STPs in Figure 1), but illegally in rivers and canals (Miller, 2006).[18]

The 2012 Master Plan can be seen as merely an engineering document while higher level policies are not in place, for example, policies for integrating development programs regarding clean water provision and water resource management, sanitary behaviour changes at the household level (mainly administered by the Ministry of Health and its local agencies), and programs for improving kampungs (mainly administered by the national and local public housing agencies). Moreover, the 2012 Master Plan has been prepared with a minimum involvement of local government agencies. The mapping of the current sanitation technical conditions and the development of the Master Plan were, in fact, mainly undertaken by some foreign agencies coordinated by a special task force formed under Kementerian PU at the national level. A member of the special task force explained that Jakarta governmental agencies were not ready to develop such plans and did not even have clear strategies for the sanitation sector development.[19]

The National Development Planning Agency, *BAPPENAS*, has actually launched a national acceleration programme for urban sanitation development (PPSP)[20] in 2009 to enable local governments, by their own human resources, to map their city's environmental sanitation problems and produce a document called *Strategi Sanitasi Kota* (city sanitation strategy*)*. The PPSP can be seen as an improvement upon the previous development approaches to water and sanitation development (see **Box 1** for the key national development programs in the last three decades). Local governments were encouraged to form an ad-hoc body at the provincial or municipal levels that brings together some sanitation-related governmental bodies. Led by the local planning agency, the ad-hoc body should identify the city's environmental sanitation problems, formulate sanitation development policies and develop related master plans. Following the failures of previous top-down sanitation development programs in the late 1980s[21], it is now believed that local agencies would understand local problems better and it was believed that planning from below would increase a sense of ownership towards development programs and projects.[22] The Jakarta Sanitation Working Group, the local water-sanitation ad-hoc body, has actually been formed, but is not functioning due to the absence of a leading sector-agency.[23]

Currently, there is no agency in Jakarta that is responsible for the overall sanitation development policies and their related instruments. In 2008, the provincial government had to reduce the number of divisions within its agencies. As a result, the section of wastewater within the Public Works Agency (*Dinas PU*) is now defunct and this has affected the performance of existing wastewater infrastructures.[24] In the late 1990s, the section of drinking water was also removed from the Dinas PU. It was assumed that the state water and wastewater companies (PAM Jaya and PDPAL Jaya) would play the role of policy makers in the sector. Some national and provincial governmental officials consider these two decisions counterproductive.[25] Without any agency responsible

sewerage networks in most cities remained under-utilized for decades (see USAID, 2006).

The IUIDP experience shows that although having integrative potential, the incorporated spatial planning processes were not neutral. Spatial planning will not afford equal attention to all sectors and this is just one of the consequences of not giving equal opportunities to all actors to influence the process. The implementation of the 1999 Law on Regional Administration in 2001, as one of the legal bases for the decentralization and regional autonomy policies, has led to the transfer of several responsibilities from the national to local governments. Likewise, water and sanitation provisions have become the task of local governments. In principle, this could be a good opportunity to include broader civil society at the local levels in the sanitation policy making processes. In the late 1990s, several senior civil servants at the national level realized that top-down policy making processes and large-scale infrastructure developments had failed to significantly increase the access, especially of the poor, to water and sanitation infrastructures. These officials from some ministries had been regularly working together to plan a yearly budget for water and sanitation development according to the annual Presidential Instruction. After 1998, the year when the centralistic and militaristic regime of Suharto fell, the Presidential Instruction was no longer used to guide the national budget allocation for development, that in practice was the only instrument for inter-ministry coordination regarding water and sanitation development according to the interviewee.

In 1998, the Australian Government launched a grant to improve access for Indonesians, particularly the poor, to adequate and sustainable water supply and environmental sanitation services through facilitating policy development, implementation, and programme management. The grant was channelled through a programme named WASPOLA and administered by the WSP-EAP (Water and Sanitation Program-East Asia and the Pacific) of the World Bank. As requested by the donor, the existing inter-ministry coordination system transformed into *Pokja AMPL Nasional* (National Working Group for Drinking Water and Environmental Sanitation Development) to become the Indonesian partner of WASPOLA. *Pokja AMPL Nasional* argued that transferring the responsibility for water-sanitation infrastructure development to local governments should become an opportunity to involve more actors in the sector's decision-making processes and to empower communities to be able to develop simpler and cheaper water-sanitation facilities. But in 1998, there was still no policy framework to accommodate bottom-up aspirations in the water and sanitation sector development.

In 2003, as one result of the partnership involving *Pokja AMPL Nasional*, the national government launched 'the National Policy for Development of Community-Based Water Supply and Environmental Sanitation'. The new national policy was designed as an instrument to promote a community-based approach in the water supply and sanitation sector. It was, in fact, the first national policy in the sector. The Policy was in line with the enactment of the 1999 laws on decentralization and regional autonomy. It was developed with the spirit of a bottom-up development approach that was at the rime arising after the end of the militaristic and centralistic regime.

Following the National Policy, there are now two important sanitation development frameworks at the national level that apply the community-based approach: SANIMAS by the Ministry of Public Works, and STBM led by the Ministry of Health (see **Table 1**). It can be seen that the National Policy, although not accompanied by a legal instrument and having a merely indicative nature, has been effective in guiding further sanitation development strategies. After the National Policy, also supported by WASPOLA, several local working groups (local Pokja AMPL) were formed to disseminate the National Policy and to formulate local strategic plans.

However, several important aspects of urban development are either missing or insufficiently developed in the 2003 National Policy (Miller, 2006) and the policy makers have tried to accommodate these aspects in the more recent national programme. In 2009, a new national strategy, embedded in a new national programme, was launched. The programme is called *Program Percepatan Pembangunan Sanitasi Permukiman* (PPSP). PPSP and promotes sanitation development as one of the top priorities within the agendas of local governments. It can be seen as an improvement to the community-based approach that has overly focused on neighbourhood development while neglecting city-wide and long-term planning. PPSP introduced a planning instrument called the 'city sanitation strategy' (*Strategi Sanitasi Kota*, SSK) to map existing sanitation conditions in a city or regency and to create a proper development strategy based on existing conditions. It adopts one integration principle of IUIDP that is the combination of neighbourhood-scale development with interventions at the higher scales. The IUIDP failed to increase the pace of sanitation development because sanitation was a minor element and there was little public participation in the programme implementation. The failure was also because the IUIDP focused on the integrated development plan of several infrastructure sectors while there was no comprehensive sectoral plan, i.e. for sanitation development. From field interviews, a sector development plan cannot be replaced by the integration plan and both types of plan have to be developed.

It was expected by the policy makers that the city sanitation strategy, SSK, should be developed at local levels without involving a third party i.e. consultancy firm in order

for developing a good public policy and regulatory framework for water and sanitation, DKI Jakarta cannot protect the citizens' rights to water and basic sanitation services.[26]

Many civil servants see that the water and wastewater companies have no capabilities to increase services to the poor because maintaining their current operations is already a real challenge.[27] This kind of assumption legitimates the fact that the government focuses on building more sewerage networks that prioritize commercial functions and upper middle class settlements 'to tap revenues through the sewers' and make the state wastewater company survive.[28] Despite being owned by the state - fully for the wastewater company and partially for the water company - the water and wastewater companies have been concentrating on making profits for the state and other shareholders. PD PAL Jaya rendered around 40 per cent after-tax income to the state (Miller, 2006) while one of the private water companies made more than 25 million USD of profit in one year (Ardhianie, 2011; see also Hadipuro & Ardhianie, 2011).

While there has been very little commitment made for the sanitation sector, the last 30 years of developments were dominated by the spirit of technology-centred solutions and the existing basic infrastructures were delivered without communities providing input on their needs.[29] High-level officials at the national level commented that developing an engineering master plan and listing suitable wastewater infrastructure facilities for Jakarta are actually not difficult.[30] The biggest problem of Jakarta is indeed the absence of effective institutional frameworks, including comprehensive sector and multi-sector development policies.[31]

For now, there is an organizational issue that needs to be addressed soon. A leading sector-agency for water and sanitation infrastructure development is vital. Some options of renewed organizational structure for water and sanitation development have been discussed by high-level civil servants, but this exploration has not reached the top-level decision making processes.[32] Some public servants in the Jakarta Public Housing Agency (*Dinas Perumahan*) have seen that their agency can take the role of managing the development of decentralized sanitation systems because they have been dealing with housing development issues in urban kampungs and are acquainted with the situation there.[33] While a political decision could unlock the organizational problem, it seems that having good policy contents to respond to the socio-spatial diversities in Jakarta is the greatest challenge.

It is a serious weakness that the provincial government of Jakarta has not used an alternative approach to understand the community dynamics and incorporate them into the policy-making processes. To a certain extent, many communities have been able to organize minimum individual responses to the sanitation needs in the form of building soak pits or porous septic tanks. In 1951 there were only four trucks emptying the sludge (Blackburn, 2011) and now there are around 188 trucks operating in the city. These facts show that there is demand for such services. Moreover, in 1954 there were only 84 public latrines in kampungs (Ibid., 2011) and it is estimated that today there are 1,263 public toilets in kampungs provided by the state, NGOs or communities (Yachiko Engineering, 2012). Although the data does not show how many public toilets are fully operational, the increased number shows that there are certain practices of utilizing shared sanitation facilities within the communities.

Unfortunately, the wider public has not put pressures on the government to provide water sanitation

Table 1. Two national sanitation development frameworks following the 2003 Policy

Year	*Framework*	*Scope*	*Historical Background*
2006	SANIMAS (sanitation by communities) was launched as a national programme by *Ministry of Public Works*	It focuses on developing domestic wastewater treatment system at neighbourhood level through a shared funding scheme between the national and local governments with community contributions. It is designed for crowded urban areas. SANIMAS introduces some models of low-cost sanitation facilities and manuals, not only for the physical construction but also to disseminate the approach, allowing local governments to replicate the development model.	The approach used in SANIMAS was introduced by BORDA, a Bremen based international organization, and its Indonesian partners through some projects. The model was continued by the network of BORDA with a support from AusAID through WSP-EAP/ the World Bank. The approach was replicated by the *Ministry of Public Works* in 2005 through some pilot projects before SANIMAS was finally launched as a national strategy.
2008	Community-Led Total Sanitation (worldwide known as CLTS, in Indonesia named STBM) was launched as a national strategy by *Ministry of Health*	Its main goal is to end open-defecation practices by introducing healthy sanitary behaviours (e.g. hand-washing with soap, safe drinking water and food consumption) and increasing willingness to invest in appropriate facilities for domestic solid waste and waste-water management. This zero subsidy strategy has been implemented in rural areas.	During 1999-2008, there were several community-based sanitation projects in rural areas. They were run by government agencies and/or international organizations e.g. Plan International, UNICEF. The success stories and the needs to replicate the projects at national scale had led to the 2008 STBM strategy.

Source: compiled by the Author based on several interviews, Pokja AMPL (2003), Sudjimah et.al (2008), AKADEMIKA (2008), Mukherjee and Shatifan (2008)

to increase local government ownership and responsibility in sanitation development. To help the planning processes, the national government provides facilitators. The approach of giving assistance through facilitators has actually been formulated through SANIMAS and STBM, the previous national sanitation development frameworks. Through an SSK, it is expected that a city can attract capital investments for sanitation infrastructure construction. Local governments are expected to perform as fund managers and regulators, instead of single providers. Part of an SSK is a sanitation infrastructure master plan that defines areas with centralized sewerage models, communal systems and on-site/ individual systems. It is assumed by the policy makers that the private sector is willing to invest in areas occupied by the middle and upper classes while the state organizes services for the poor through several communal systems that could be later connected to the main sewerage networks.

Prior to PPSP, there were six pilot projects in 2006 under the programme scheme called Indonesia Sanitation Sector Development Program (ISSDP) that was jointly funded by BAPPENAS (the national planning agency), the Netherlands Embassy through Indonesia Water and Sanitation Program (WASAP) and the Swedish Agency for International Development (SIDA). The ISSDP's objective was not to deliver new direct investments. Rather, it aimed to foster an enabling environment for progress in the sanitation sector by assisting the local governments in the planning process, as opposed to just enhancing the policy and strategy at the national level and increasing awareness at all levels. The outputs were city sanitation strategies for the six cities. PPSP is now jointly funded by several financial schemes including those involved in ISSDP. According to targets set by PPSP by 2014, some 330 cities/regencies should have city sanitation strategies (SSK) in place. This programme has been integrated under the National Mid-term Development Plan in order to gain broad political support and to ensure regular budget allocation.

SSK could potentially be an instrument for a comprehensive sanitation development plan, but unfortunately there has been no instrument to link the sanitation sector with other urban infrastructure development initiatives. Spatial planning has the potential to integrate the different needs of various development sectors, but it currently plays a minimal role as it is organized and practiced as nothing more than mere land-use planning.

* * *Based on the author's case-study research, including interviews with: the director of Directorate of Housing and Settlement, BAPPENAS, 5 November 2010; former head of Division of Drinking Water and Waste Water, BAPPENAS, 7 April 2011; former director at Directorate General of Human Settlements, Ministry of PU, 3 November 2010; former staff of West Java IUIDP, 26 July 2010; former director of Directorate of Environmental Sanitation Development, Ministry of PU, 27 January 2012; the head of Division of Wastewater, Ministry of PU, 11 February 2011*

infrastructures for all by applying different technological models, responding to the diverse environmental problems. KRuHA, a national NGO and its consortium, has been actively advocating a stronger role of the state for providing water and sanitation services and demanding the government to stop the privatization[34], but the NGO has not promoted collaborations to find alternatives outside the models of centralized piped water and sewerage networks that can stimulate communities to manage infrastructures in a collective manner. Indeed, it is not an easy task to train communities to become more proactive and increase their political consciousness to solve their daily problems.[35]

3.2. Some Rooms for Improvements: Learning from Bangkok

Both Jakarta and Bangkok have to deal with uncontrolled spatial developments leading to fragmented spatial configurations. This spatial fragmentation has brought many layers of complexity in governing the water sector. Bangkok, however, has achieved better progress in wastewater management.

Bangkok has seven zones of centralized wastewater treatment system (see **Figure 3)** that covers 12 per cent of its area and serves around 30 per cent of the needs (Sujaritpong & Nitivattananon, 2009; Suriyachan et al., 2012). The Bangkok Metropolitan Administration (BMA) began to develop the sewerage systems in the early 1990s and, since the beginning, it has realized the needs to divide the service area into several zones (Suriyachan et al., 2012).

Along with planning the sewerage systems, BMA also incorporates the earlier strategy to develop smaller-scale wastewater treatment facilities. Prior to the development of centralized sewerage systems, Bangkok had established a wastewater management system in which communities of housing complexes are served with local treatment plants, either constructed and operated by private developers and housing estate associations or the Ministry of Interior and the National Housing Authority (NHA) (Sujaritpong & Nitivattananon, 2009; Suriyachan et al., 2012). This management system was enhanced by the 2000 Land Subdivision Act that classifies housing estates by the number of house units and the total area of land development to further control the infrastructural facilities, including the required wastewater treatment systems (see Sujaritpong & Nitivattananon, 2009). In 1990, BMA had improved thirteen communal wastewater treatment systems owned by the NHA (see Figure 3) and most of the communities of the state housing estates are now able to recycle and reuse wastewater for e.g. cleansing and watering greeneries (see Suriyachan et al., 2012). **Table 2** provides information of these local treatment systems.

It is only logical and strategic to couple housing development and domestic wastewater management strategies, as shown in the case of Bangkok from which Jakarta should learn. If housing estates in Jakarta, developed by either the state or private developers, are equipped with wastewater treatment plants, a significant area of the city can already be covered by wastewater infrastructure services (see the spatial distribution of state-led planned settlements in **Figure 1**). The Indonesian government through the Ministry of Public Works launched a pilot project in the 1990s to introduce a local wastewater treatment system in one of Jakarta's state-developed housing complexes (see **Box 2**), but the project did not create a good impact in the policy making

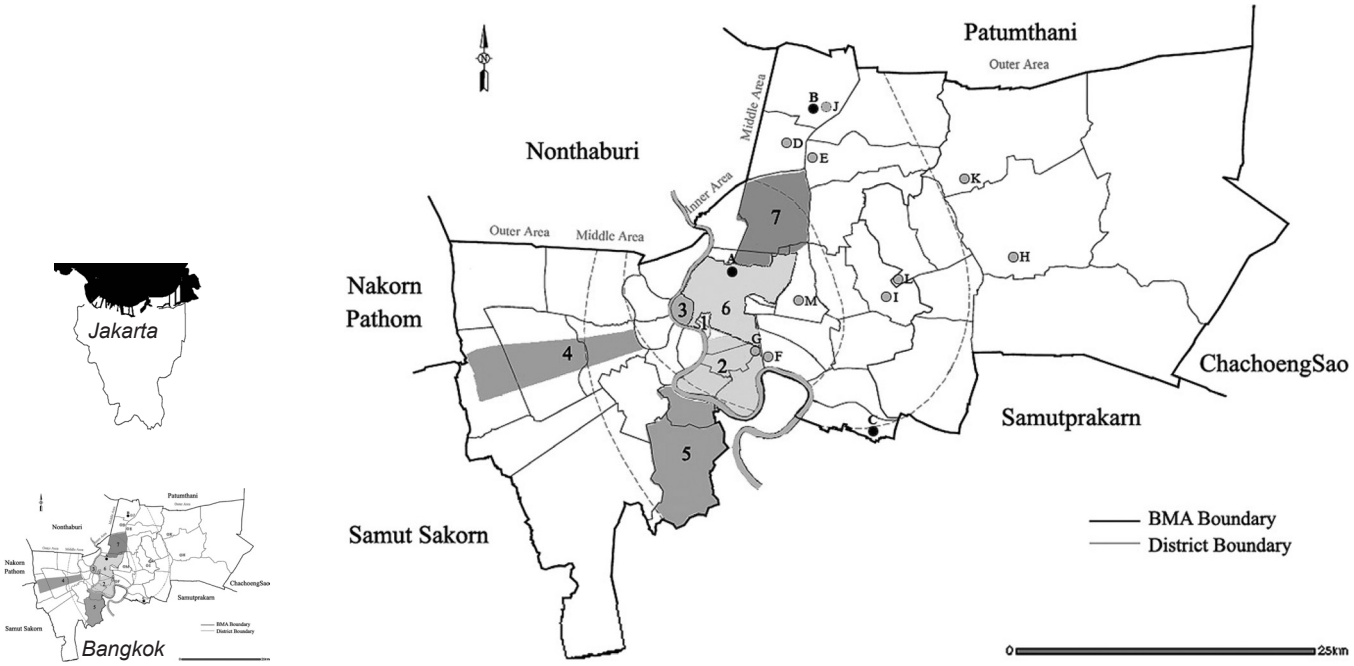

Figure 3.
The Locations of Centralized (1-7) and Decentralized Wastewater Treatment Systems in Bangkok (A-M)

Source:
Suriyachan et al. (2012)

Table 2. State-led local wastewater treatment systems in Bangkok

No	*Wastewater plant*	*Capacity (m^3/d)*	*Service area (ha)*	*Service population*	*Areas of plant (m^2)*	*Average BOD effluent (mg/l)*[a]
A	Pibun Wattana	400	16	2100	500	10.24
B	Tung Song Hong 1	3000	43	15000	9700	15.52
C	Bang Na	1300	9	8300	3430	7.62
D	Tasai	1400	37	7100	2600	10.07
E	Bang Bua	1200	13	6100	5670	14.13
F	Khlong Toey	1200	5	7200	560	9.23
G	Bon Kai	400	1	1900	500	9.87
H	Rom Klao	3800	128	19200	9600	12.43
I	Hua Mark	1500	15	2900	7200	13.32
J	Tung Song Hong 2	1100	5	5600	1800	16.11
K	Ram Indra	800	8	4100	2110	13.47
L	Khlong Chan	4500	49	32200	9030	11.77
M	Huai Khwang	2400	13	16800	5200	15.69
	Total	*23000*	*342*	*128500*	*57900*	

[a] Average BOD effluent was calculated from 2005 to 2007 data

Source: BMA (2006) in Suriyachan et al. (2012)

processes and the spatial planning practices, thus it has not been replicated.

The private sector actually knows how to deal with environmental problems and has the capacity to manage externalities that might harm their businesses by, among others, improving their wastewater infrastructures. For example, in Jakarta many private buildings have begun to recycle their wastewater and the reclaimed water is used for cooling, flushing and cleansing because the government has significantly increased the tax for utilizing ground water since 2009 (interview 6b). Another example from Jakarta, there have been efforts to standardize practices in the property sector for high-rise structures that should become energy efficient and constructed by use of environmentally-sound technologies and construction materials.[36] These efforts were initiated by some actors affiliated to Green Building Council Indonesia (GBC Indonesia), consisting members of business corporate, planners, architects and some other professionals, highly supported by professional associations.[37] There have also been campaigns to promote hygienic toilets in airports and shopping malls.[38] In short, there are mechanisms to promote green and healthy practices among actors in the private sectors as environmental sanitation goods figure among the parameters to ensure competitiveness and sanitary products have become commodities in the property sector. However, this market behaviour trend needs to be regulated by the state so that these kind of environmental benefits are not only enjoyed by those who could afford well-designed private buildings.

Indeed, the experience of Bangkok shows a good policy approach benefitting only those living in the state-led planned settlements. Perhaps, there has been a success of developing decentralized wastewater management systems for slum populations in Bangkok, which the author of this paper is not aware of. In the above case of Jakarta, the actors in the private sector and their consumers form a small part of the population. Communities in kampungs, including squatters and slum dwellers, who do not have capabilities to tackle their environmental sanitation problems, form a larger part of the population in the city (Mercy Corps, 2008; URDI & Mercy Corps, 2008). Most inhabitants of kampungs live for survival while they are facing several uncertainties related to the future of their settlements and jobs. Thus, they cannot effectively cope with their environmental problems or accumulate some surplus income to invest in sanitation infrastructures even though they would like to improve their situation (Douglass, 1992; Winayanti & Lang, 2004).

Suriyachan (2012) proposes that the application of decentralized wastewater management shall be categorized based on 'the community organization structures', apart from the technological systems used, i.e. on-site or off-site systems. In the case of Bangkok, small-scale wastewater treatment systems can be organized based on the spatial distributions of low-income communities or slums, housing estate communities, the communities of National Housing Authority, urban and sub-urban communities (Ibid., 2012). In this way, informal settlements can be recognized as a specific entity within the policy-making processes, among other types of spatial enclaves. Moreover, this strategy allows a growing knowledge of 'intermediate' wastewater treatment systems; this strategy would encourage different models and scopes of collective wastewater treatment facilities, unlike the Jakarta 2012 wastewater master plan that only enhances two 'extreme' options: the centralized sewerage or the individual on-site systems.

BOX 2. The case of Perumahan Malaka Sari, Jakarta * * *

In 1993, a pilot project of a small-scale sewerage system and a wastewater treatment plant was delivered by the Ministry of Public Works in Perumahan Malaka Sari. This infrastructure was designed to also treat grey water. It now provides a service to around 500 households (+/- 2000 people) from which around 200 are relatively 'new' customers, whose houses were connected after the project's completion year. While the new customers had to pay some connection fees and provide the construction materials, the 1993 connections were fully funded by the national government. Today, the operational cost is borne by the provincial government of DKI Jakarta.

In many occasions of the author's interviews with some officials of the national government, the project was often considered a failure because it was delivered through top-down processes. It has thus gained a low degree of local government ownership, and the operation has become a burden for the local government's budget. DKI Jakarta has never conducted a thorough evaluation of the project to inform the processes of setting a clear policy on decentralized wastewater management in general, and for the future improvement of this infrastructure in particular. The only existing plan regarding the Malaka Sari wastewater management system is to hand over the property to PDPAL Jaya, the provincial wastewater company, and to charge the users a monthly fee.

Still, the community of the Perumahan highly appreciates the facility. The users of the sewerage system in Malaka Sari are, in fact, as it has been assessed by PDPAL Jaya, willing to pay as much as around 1 USD per household per month; this amount was estimated by the wastewater company only to cover the operational, but not the maintenance costs. Having their toilets and sinks connected to the sewers, the community members whose plots of land are not bigger than 90 m^2 do not need to keep their conventional septic tanks. Many septic tanks in Indonesian cities are actually soak pits or leach pits (see Blackett & Sukarma, 2005; Napitupulu & Hutton, 2008), that need to be located at a minimum of 15 meters from any water source. On such small plots, the households are unable to apply the minimum distance between their conventional porous septic tanks and their wells. Hence, the sewerage and wastewater treatment system is considered useful to protect the quality of their water sources. Many other households wanted their houses to be connected to the network, but unfortunately their houses cannot be reached by the main sewer trunk and the capacity of the treatment system does not allow additional connections.

The previous manager for wastewater management at the Public Works Agency of DKI Jakarta Province was somewhat proud of the facility because under her leadership, the treatment plant had been maintained, renovated and improved. She had a vision to increase the quality of the effluent so that it could be reclaimed and used, for example for cleansing and flushing, instead of just being discharged to the environment. Since 2008, the responsibility was taken away from the public works agency and assigned temporarily to the environmental agency, BPLHD. Unfortunately, the vision to recycle and reuse wastewater in Malaka Sari has not been used in improving the treatment facility.

** * * Mainly based on the author's interviews with:*

former leader of Section Wastewater, Jakarta PU, 20 January 2011

the operator of Malaka Sari Plant, 25 January 2011

the head of Jakarta Bureau of City Infrastructures and Facilities, 04 November 2010

staff of Technical Division, PD PAL Jaya, 17 January 2011 and 29 March 2012

former technical director - current financial director of PD PAL Jaya, 20 January 2011

4. A PERSPECTIVE FROM *KALIDERES SUB-DISTRICT*

Kalideres sub-district is located in the North Jakarta municipality and consists of sixteen neighbourhood units called *Rukun Warga* (*RW*). Until 2030, as the 2012 Master Plan states, Kalideres sub-district is excluded from the priority areas for sewerage expansion. This could lead to opportunities for local stakeholders developing decentralized domestic wastewater management systems. But, the fragmented spatial distributions of housing estates and kampungs in the sub-district will pose some challenges for the municipality in developing a strategy of wastewater management that allows an active role of its heterogeneous communities. While there has not been such a strategy at the city-wide level, an international NGO has initiated a sanitation development programme in one of the kampungs in the area.

4.1. The PUSH Sanitation Intervention and its Sequel

Kampung Kojan is officially known as RW 6, which is inhabited by approximately six thousand people or between 1500 and 1700 families.[39] Labourers and low-level employees compose around 16 per cent of the population (interpolated from the demographic data of Kalideres subdistrict, 2011) and many of them work on short-term contracts in the factories and warehouses located nearby. The population also includes a significant number of petty traders and owners of rental houses/rooms, with some 41 per cent of the households in the kampung rent a house or room (SUEZ Environment & Mercy Corps, 2010).

Mercy Corps (hereafter MC), a non-governmental organization founded in the United States, has been working in Kampung Kojan for delivering several development projects. MC is one among few organizations that has been consistently working on urban poverty issues, especially in Jakarta. Between May 2009 and December 2010, MC delivered Program of Urban Sanitation & Hygiene Promotion (hereafter PUSH) in three 'phases'[40] with funding from Suez Environment Foundation. Accompanied by campaigns and training for improved sanitary behaviours, the main project involved testing an alternative technology of modular septic tanks meeting quality standards set by DKI Jakarta Province.[41] In the three phases, the PUSH project benefits 219 households in Kampung Kojan.

The design of the septic tank was quite innovative. It adapts the government-standardized septic tank by proposing two smaller separate compartments (or three if it includes the treatment for grey water) instead of a single bulky container with internal partitions. The two compartments were designed for storing the sludge and for treating the liquid material before discharging it into the ground or water bodies. As long as the bio-filter in the second compartment is functioning, effluent water from the tank is safe enough to be discharged into the environment. While maintenance or replacement of the filter can be organized by owners individually on an occasional basis, septage treatment needs to be organized collectively. One unit of the septic tank is around 200-250 USD and this is relatively cheap compared to the model designed by the government (SUEZ Environment & Mercy Corps, 2010).

The modular shapes can be rectangular or circular. Both the shape and distance between the two compartments can be adjusted to the availability of land,

3. The meeting of three main canals in Kojan

4. The canal bordering Jakarta and Tangerang Province

5. A site for fish-breeding and aquaculture development, owned by the provincial agency

6. A road access to/in Citra Garden Real Estate

2. The main access to Kojan

1. Graveyard

Figure 4. Kampung Kojan, the Surroundings and PUSH Beneficiary Distribution
Source: Redrawn by the author based on Kalideres Subdistrict official map (2004) and Mercy Corps' data

considering that most households live on plots of land covering less than 70m^2, and about 32 per cent live on plots of under 29m^2 (SUEZ Environment and Mercy Corps, 2010). Made from concrete, the modular elements can be moulded on-site and installed with some bricks and mortars. These construction materials are available in the market and familiar for local builders; MC has developed a construction management system that involves local contractors and masons.[42] Ready-to-install septic tanks are actually available in the market, but they are made from fiberglass that might be new to local construction workers and their price is much higher. Moreover, according to MC, the maintenance is more complicated and the effluent will need to be chlorinated which is quite costly (Ibid., 2010).

In the first two phases of PUSH, individual houses were selected, but in the third phase, MC changed its strategy in selecting the beneficiaries. In the last stage, owners of rental houses were targeted and 35 septic tanks for communal latrines were delivered. MC made an agreement that all of the beneficiaries had to provide some volumes of cement, sand and some bricks that all together were equal to ten per cent of the material costs. In the case of communal septic tanks, it was the tenants who covered the cost collectively and not the landlords. Through interviews with the author, some tenants in Kampung Kojan expressed that they had enjoyed immediate benefits of having latrines in close proximity to their rental rooms. In the last phase, MC also introduced an improved public latrine with septic tank and clean water supply from the state network and a newly built well. The strategy to provide communal and public facilities has addressed the needs of tenants, including temporary workers and circular migrants, who can be considered the poorest groups among the community. In Kampung Kojan, like commonly found in other places, many cheap rental rooms do not have bathrooms and toilets. **Figure 4** shows the approximate geographical distribution of septic tanks delivered by MC.

It can be argued that, fundamentally, there are two main technical problems of wastewater management: to collect and to treat wastewater. There are different technological options and varying combinations of their applications for having these two tasks done (see *appendixes*, for examples of different methods of wastewater management). This paper is not dedicated to evaluate these different methods and suggest the best technological options for the case of Kampung Kojan and Kalideres sub-district. Instead, the author seeks to, first, understand what leads an agency, i.e. Mercy Corps, to opt for introducing a certain technological system, i.e. improved septic tanks, in their development projects. Second, it will be shown that there are several socio-technical consequences following the implementation of a certain wastewater collection system.

The manager of PUSH explained that a local sewerage system had been considered before it was decided to promote improved individual septic tanks, but technically it is complicated to dig the ground for installing pipe networks in the crowded and morphologically heterogeneous settlements.[43] Besides, the kampung is located in low land with high ground water table while pipe networks require a certain inclination. An engineer of MC[44] also argued that a septic tank system with proper desludging processes is probably still the simplest model of decentralized wastewater management in crowded urban areas (see also Moersid, 1998).

During an interview with the author, a high official of BAPPENAS expressed his opinion that Jakarta could start improving its wastewater management by regulating

on-site sanitation systems, especially upgrading the quality of household septic tanks.[45] Although they have not been built and maintained properly, septic tanks are now used by the majority of the population. It is feasible to improve the household system at a high pace while installing a large sewerage network will require a much longer time. However, he added, *this has to be seen not as a final solution.* The use of proper septic tanks can be seen as the embryo of tertiary networks that later on could be connected to the main sewerage networks or other systems of local end-treatment facilities.

In the beginning of the project, MC conducted a study suggesting that in the future their two-compartment individual septic tanks can be upgraded into a collective treatment system. What is seen as feasible is that effluent from the septic tank could be discharged into a network of simple sewers for further treatment processes (SUEZ Environment & Mercy Corps, 2010). In principle, the presence of household interceptor tanks (septic tank, Imhoff tank, or other types of sedimentation tanks) would simplify the technical requirements of a local sewerage system, for example the one that is widely known as 'small-bore sewers' – to be more accurate, these can be called 'solids-free sewers' or 'effluent drains' (Otis & Mara, 1985).

It is a pity that many beneficiaries who live in close vicinity were not grouped into one system and provided with one bigger tank. **Figure 5** shows three septic tanks in Kampung Kojan that were located in a very close proximity to each other. Technically, a communal system is better than an individual one. In the future, it becomes possible to increase the service coverage of the communal septic tanks by linking them with more latrines in the surrounding and/or upgrade them as end-treatment systems. Besides, at the bigger scale, it is easier to control and manage fewer numbers of septic tanks

Figure 5.
Three two-compartment septic tanks delivered by Mercy Corps in Kampung Kojan

Source: the author, 2011

as pre-treatment instruments. During calamities like flooding, especially in lowlands like North Jakarta, septic tanks have a risk of leaking and polluting the ground or groundwater. Continuing the practice of one-house-one-septic-tank means to increase the number of pollutant injection-spots in the city. This practice will make Jakarta keep growing as a metropolis with 'millions of septic tanks'.[46]

Mercy Corps saw that the communities' awareness of the importance of collective sanitation infrastructures is still very low.[47] In the beginning of the program, MC consulted the beneficiaries whether they wanted to have an individual septic tank or a shared one.[48] Almost all of them, even those living in adjacent houses and have close relationships, preferred individual treatment systems. The consideration was mainly a practical reason to maintain the infrastructure without needing consensus among individuals beyond a household.[49] The project had a limited time-span; it seems that there was no sufficient time to encourage the beneficiaries to opt for communal septic tanks and organize pipe-connectors across plots of land to link individual wastewater outlets to the shared septic tanks. A use of communal septic tanks could actually be the first step to introduce the benefit of having shared wastewater treatment facilities.

Communal septic tanks can be constructed simultaneously with an improvement of the existing open space. Open space in Kampung Kojan is fairly limited. Some of the rental rooms for workers were constructed around tiny inner courtyards. The existing open space, including the places along water bodies, is used not only for socializing but also for drying washed clothes as well as the washing activity itself.

MC realized that what had been initiated through the PUSH projects would not capacitate the community to manage wastewater independently.[50] In the third stage of PUSH, the initiative was integrated with another MC's programme called OWOF. Since 2008, MC Indonesia has been implementing Our Worlds Our Family (OWOF), a global Western Union Foundation programme with the ultimate goal to improve the resilience of vulnerable households in coping with and adapting to internal and external challenges particularly to their livelihood activities. In Jakarta, part of the OWOF was to enhance the PUSH projects considering that the water and sanitation sector is closely related with household livelihoods. MC found that illness of any family member causes extra expenditures for health treatments, including the cost of transportation to health care centres, and this often leads to a fall in real income.[51]

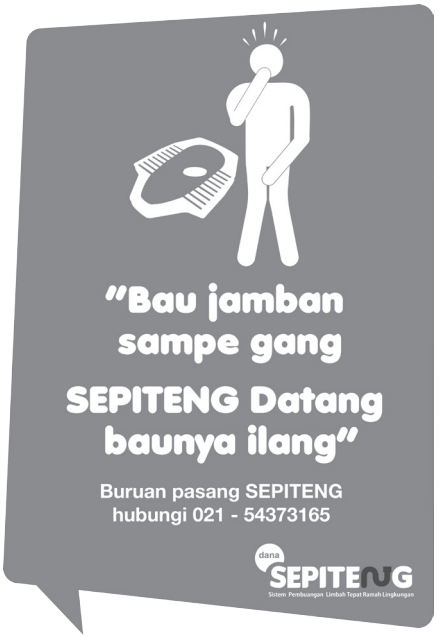

Figure 6. A flyer saying: 'The smell reaches the alley, but when septic-tank comes, it's gone. Quick, install one! Call [the number]'. *Source: Mercy Corps, 2011*

Another reason for enhancing the wastewater management system utilizing household septic tanks is that the desludging process can create new jobs and open entrepreneurship opportunities.[52] Within the OWOF program, an entrepreneurship system called *PELITA* (an abbreviation of *PEngolahan LImbah TinjA* – Faecal Waste Treatment) was created to provide services to haul the sludge from septic tanks. MC also assisted a cooperative (*KJK Kalideres*) to deal with financing issues in sanitation infrastructure development. Through the OWOF project, MC tried to initiate a broader institutional arrangement for sanitation development at a higher spatial scale, beyond the level of a kampung. Both the cooperative and PELITA were designed to operate at the sub-district level.

Together with KJK Kalideres, MC aimed to develop a sanitation marketing system, promoting a micro-finance scheme in the form of revolving funds that allow a family to get soft loans and a small subsidy to install an improved latrine and/or modular septic tank that has been introduced in PUSH.[53] It was expected that an increased demand of the septic tanks would trigger local business entities to produce the modular concrete elements of the tanks.[54] **Figure 6** shows an example of flyers produced by the cooperative to promote the use of septic tanks. Supported by MC, the cooperative formed community working groups to not only campaign for the importance of sanitation and hygiene behaviour changes, but also to promote the soft loan system.[55] Volunteers

Figure 7.
Muhasan, the operator of PELITA and the vehicles for desludging septic tanks

Source: the author, 2011

who could successfully gain new borrowers would receive small cash compensations.[56] The microfinance programme implementation has not been evaluated, thus it is not known if the strategy can effectively increase the community awareness on the importance of and willingness to invest in domestic sanitation infrastructures.

While the cooperative mainly deals with financing issues, PELITA was created to accumulate and increase local technical knowledge and engineering skills in sludge management. MC designed and funded two small motorized vehicles to collect sludge from individual septic tanks that need to be operated by two persons (see **Figure 7**). The vehicle was designed to operate in small alleys that cannot be reached by the municipal's desludging trucks.

PELITA has been facing some difficulties. In one operating day, often there was only one call for a desludging service. PELITA can only provide sludge-collecting-services at the sub-district level and the vehicles still need to transfer the sludge to a city sludge hauler truck for transporting it to dedicated STPs. The normal tariff is applied for PELITA if they use the city sludge hauling trucks. If it is only one call a day for PELITA to empty a septic tank, it cannot cover the total operation costs.[57] Unfortunately, MC has not managed to help PELITA finding a piece of land to build temporary storage for the sludge before transferring it to the city trucks.[58]

Also funded within the OWOF and integrated with another sanitation development programme called

Figure 8.
A push cart for desludging septic tanks

Source: courtesy of Hendratmo, Mercy Corps

RW Siaga Plus, MC developed other small enterprises outside Kalideres sub-district.[59] These community business entities are similar to PELITA, also providing services for desludging septic tanks, but with a pushcart named KEDOTENG (an abbreviation for *KEreta DOrong SepiTENG* – Septic-tank Push Chart). The pushcart, like the one in **Figure 9,** was designed to reach the smallest alleys in Jakarta's kampungs. Some KEDOTENG can now be found in four sub-districts in the Jakarta Metropolitan Area. MC has supported the formation of an association to unite the sludge haulage enterprises and mediated between this association and PDPAL Jaya, the wastewater company, to sign an agreement regarding sludge transport to the dedicated STPs. It was expected that through the agreement, the wastewater company could assist the small sludge haulage enterprises to optimize their services in the long run. But by the end of this research, an agreement had not been reached.[60]

A high-level national official commented that the initiatives of MC should have been improved and become independent of the state system. MC should offer a complete treatment cycle, for example by providing a bio-gas reactor plant for the end-treatment system.[61] In the past, he explained, similar sludge hauler vehicles have been introduced but the community stopped using them because they did not find an immediate benefit of treating wastewater by installing improved septic tanks and regularly hauling the sludge. If it can be shown that wastewater can be turned into a useful product, for example an energy resource or clean water for domestic flushing, actors in the informal sector would be motivated to promote and sustain the practice of desludging septic tanks regularly and recycling wastewater.[62] However, for an effective bio-gas installation or wastewater recycling system, a certain scale of waste collection is needed.[63] The senior echelon interviewed above believed that an effective system of bio-gas installation would be at a district level, but this assumption has not been tested in Jakarta. For sure, at this level of development interventions, the role of local government is crucial.

4.2. Potentials and Challenges beyond the Kampung Scale

Any model of decentralized water management will take up a significant proportion of the land area in a neighbourhood for its implementation, but, as proven in Bangkok (Suriyachan et al., 2012), the surface of land required for the installation of a final treatment plant within a decentralized wastewater management system is much smaller compared to that required by a city-wide centralized system. Decentralized wastewater management can be implemented by splitting the total surface area needed for treating wastewater into some segments (especially if using the system of constructed wetlands, see *appendixes*). Usually, it is easier to find smaller vacant land plots within the fragmented urban fabric (see also an example in Paper 4).

With any combination of collection and treatment systems, the applications of decentralized wastewater management could structure the creation of public spaces in Jakarta. Many practitioners interviewed above see that the use of septic tanks linked with a community sludge hauling system can fit in Jakarta's kampungs, which are characterized by irregular road patterns and small alleys. Further improvement with local simplified sewerage systems would mean improving the spatial quality of urban kampungs because the space in between houses have to be arranged for the new pipelines and this can be an opportunity to design common open spaces. At or

beyond the kampung level, communities need additional spaces to treat wastewater collected by the pipelines or to dispose and treat the sludge carried by the push-charts or small vehicles. At the scale of Kalideres sub-district, it seems that final wastewater treatment facilities can be utilized together by adjacent kampungs and housing estates. This might be an opportunity to create open spaces with shared ownerships between neighbourhoods.

The experience in Kampung Kojan has not shown a successful implementation of decentralized wastewater management in Jakarta. The initiatives at the neighbourhood level were mainly dealing with the needs of collecting faecal wastewater (black water), but there have not been proper solutions for treating it. Moreover, grey water management has not been introduced, thus, the overall intervention is far from meeting the needs of a complete cycle of wastewater treatment processes. Grey water can make up to 80 per cent of the total household wastewater (Li et al., 2009). Indeed, the presence of Mercy Corps and KJK Kalideres, the cooperative, were vital to assist the communities to understand environmental sanitation problems.[64] The interventions have offered alternative technological options for household wastewater collection, but there is no effective higher institutional arrangement that can support the introduced technological model to function well and be upgraded as parts of a city-wide wastewater management system. Certain institutional settings that are necessary to anchor the local initiatives to long-term sanitation development processes have not existed yet. Organized by the sub-district government, neighbourhood leaders could have been involved more in organizing the community to reach a consensus for collective sanitation infrastructures. The involvement of governmental agencies is essential, because after the completion of a project, an NGO has no further engagement with the community, thus state institutions and community organizations are needed to continue the initiative.

5. CONCLUDING REMARKS

This paper has shown that the different sanitation needs embedded in the heterogeneous spatial dynamics of Jakarta have not been adequately met by state-led sanitation infrastructure provisions. The government has focused its efforts on expanding the centralized sewerage system, but only prioritized areas with high numbers of major commercial facilities. However, expansion of the centralized sewer network remains slow because the full cost of sanitation services must be recovered through user charges; this effectively limits the centralized wastewater management system to areas with reliable purchasing power. Many communities remain underserved, whereas better-off households living in private housing estates have the means to keep their bodies healthy.

This paper suggests the implementation of decentralized wastewater management for two main reasons. First, it can overcome the technological bottlenecks inherent to the centralized system. Decentralizing wastewater management also means widening the technological options involved in environmental sanitation management. This paper has discussed two inter-related sanitation development projects in one of Jakarta's kampungs. These projects were designed to enhance use of septic tanks for domestic wastewater treatment, and then link their use to a network of sludge hauling enterprises. Although the projects together are only halfway to becoming a complete unit of decentralized wastewater management, this paper

has shown the potential of technical methods to provide a complete cycle of wastewater management for the neighbourhood.

Diversifying technology is one step towards involving different stakeholder groups in wastewater management. This leads us to the second reason for implementing a decentralized approach to wastewater management. As shown in the case of Kampung Kojan, decentralizing wastewater management means creating (potential) political space at the very local level, enabling stakeholder participation in planning and decision-making processes. This political space includes alternative ways to finance household infrastructure development. In Kampung Kojan, a practice of sharing costs was introduced to build latrines and septic tanks, involving the NGO, landowners and their tenants. Sharing service production costs may enable payers to gain more control over service quality and means of accessing the service.

Indeed, affordability is a key issue when building (shared) latrines and septic tanks in the kampung. Although the NGO met most of the costs, decisions must also be taken as regards who should meet the cost of maintenance and further improvements to the system. As yet, no solution has been found to the question of how poor households will maintain their sanitation and have the chance to upgrade their shared latrines and septic tanks without spending a large portion of their income. NGO managers often assume that community sludge hauling enterprises may be able to accumulate a profit. Although this has not been reflected in reality, some may think that this potential profit could fund a local welfare system, while others may see it as an exclusive income source for particular community members. Certainly, a greater and solid involvement of communities is crucial for the success and sustainability of the development projects – and this is often a problem.

The case of Jakarta and Kampung Kojan show that there are complex institutional challenges involved in providing a complete wastewater treatment cycle at neighbourhood level. Improvements in local wastewater infrastructure systems need higher institutional arrangements beyond the sub-district level, with the state playing a greater and stronger role. Certain institutional reforms are needed within the DKI Jakarta Provincial Government to move away from the centralized sewerage system as the only technical solution to environmental sanitation problems. The government needs to develop a city-wide sanitation development strategy that integrates various domestic wastewater management practices while ensuring the overall quality of environmental sanitation services and their accessibility to the community. The projects examined in this paper have benefited only a small number of households in Jakarta's kampungs. Meanwhile, some communities and private sector players have been utilizing individual on-site sanitation systems, but these wastewater facilities need to be improved in order to solve environmental problems at the neighbourhood level. Unless the provincial government develops an overall sanitation development strategy and a long-term vision for local community development, it is difficult for any actor to deliver, replicate and/or upscale small-scale sanitation projects and integrate them into the city-wide infrastructure system.

There are many ways to design a decentralized wastewater management system at a neighbourhood level (Tilley et al., 2008 provide a review of different technological systems and their additional benefits for communities). With such a wide range of technological options for implementing decentralized wastewater management, an enabling environment, including long-term government support, becomes fundamentally

important (Ibid., 2008). Planners' main responsibility would consist in identifying possible technological options that comply with local specificities, i.e. climate, community knowledge, and institutional infrastructures. But broader participation is needed to decide at which scale each unit of a decentralized wastewater management system should be developed: should a treatment system unit serve one or two kampungs, or one housing estate and the adjacent kampung? These decisions must be taken by incorporating user preferences and local providers.

It seems that improving the existing wastewater management services in housing estates would be the most visible working agenda for the Jakarta government. Most of these housing estates already have good drainage systems and a fairly uniform morphological pattern of physical structure (see also Figure 7 in Chapter 2). As such, it is technically possible to tap grey water and effluent from improved septic tanks or lay down an additional sewer system for black water. Besides, housing estate communities have relatively higher income levels and can meet the costs of such infrastructure services. The situation in urban kampungs is rather different. The case of Kampung Kojan exemplifies the difficulties to be addressed when seeking to improve wastewater management in a kampung of Jakarta. If a decentralized wastewater management system is to serve kampung communities, it must enable income regeneration by recycling and making use of effluents. Domestic wastewater is not just something to be disposed of; it should also be seen as a resource. This encourages households to organize themselves to manage their domestic wastewater. Indeed, the availability of land is important to decentralized wastewater management. In fact, not all urban kampungs have developed on the city's periphery. Indeed, given the heterogeneous environmental and socio-cultural conditions in Jakarta, the government mandate should include mastering a diversity of (alternative) technological options for wastewater management.

Hence, decentralizing wastewater management is not without challenges, and perhaps it raises new issues that are currently not addressed by the governance of centralized wastewater management systems. Decentralized wastewater management requires effective governance systems that operate simultaneously at different scales. The case of Kampung Kojan shows that many neighbourhood-scale decision-making processes – between households and between two or more community groups – in fact depend on different dynamics at other scales of governance, involving the state wastewater company or international NGO, as well as the national policies in that sector. Likewise, dynamics at the neighbourhood scale feed crucial information back for defining development and operating strategies at the city-wide level.

In Jakarta, the day-to-day activities of governmental bodies have long been moulded to the implementation of a centralized water management system. Implementing decentralized wastewater management opens up possibilities for bottom-up yet integrated planning processes that can accommodate the different environmental problems of heterogeneous localities. Looking simultaneously at wastewater management problems at different scales leads to awareness that the sector's problems can only be resolved by collaboration between professionals from different fields. One starting point could be to create synergies between the works of several governmental agencies. Conventionally, for example, sanitarians focus more on interventions at the household level while water managers

tend to prioritize problems at the urban scale and believe in large-scale water works.

This paper advocates the need for co-existence between off-site and on-site wastewater treatment systems. Co-existence between centralized and decentralized wastewater management systems would drive co-existence between state-led and community-led planning systems. The different characteristics of territorialized communities need flexible development policies, implemented using multiple administration techniques and operating procedures (see also Chatterjee, 2004). Hence, there is a need to examine further how actors involved in both types of system can co-govern development in the environmental sanitation sector. This requires further research into community dynamics. It is necessary to understand under which circumstances community members are willing to co-operate with each other to collectively provide solutions to their environmental sanitation problems and beyond.

NOTES

1. A 'kampung' refers to an enclave of traditional settlement that is now often categorized as an informal settlement in the city.

2. Considering the presence of floating population, it is estimated that the actual population of Jakarta is more than thirteen million people (Yachiko Engineering, 2012).

3. This research was done during the Fauzi Bowo administration (2007-12). The current Joko Widodo government has been seen as consistently implementing pro-poor public policies. However, this research did not examine whether his popular policies also included some innovations and improvements in the wastewater sector and other sectors that have been marginalized within the decision making processes.

4. Based on the author's interview with: the head of Jakarta Bureau of City Infrastructures and Facilities, 04 November 2010; the head of Jakarta Bureau of Spatial Planning and Environment, 28 March 2012

5. Based on the author's interview with ^{the} head of Jakarta Bureau of City Infrastructures and Facilities, 04 November 2010

6. Based on the author's interview with the head of Jakarta Bureau of Spatial Planning and Environment, 28 March 2012

7. Based on the author's interview with former technical director - current financial director of PD PAL Jaya, 20 January 2011

8. Based on the author's interview with: the Leader of Section of Habitat and Environmental Sanitation Control, BPLHD, 8 November 2010; the head of Jakarta Bureau of City Infrastructures and Facilities, 04 November 2010; former technical director - current financial director of PD PAL Jaya, 20 January 2011

9. Based on the author's interview with: staff, Building Authority Agency, North Jakarta Municipality, 19 October 2012; the leader of Section of Habitat and Environmental Sanitation Control, BPLHD, 8 November 2010;

10. the head of Jakarta Bureau of City Infrastructures and Facilities, 04 November 2010; the head of Spatial Planning Agency, West Jakarta Municipality, 9 January 2012; the head of Division of Urban Spatial Planning, Jakarta Spatial Planning Agency, 14 March 2012

11. The leader and a staff of Section of Habitat and Environmental Sanitation Control, BPLHD during an interview with the author on 8 November 2010

12. A staff of Section of Habitat and Environmental Sanitation Control, BPLHD during an interview with the author on 8 November 2010

13. Former director of Directorate of Environmental Sanitation Development, Ministry of PU during an interview with the author on 27 January 2012

14. Based on the author's interview with: staff of Technical Division, PD PAL Jaya, 17 January 2011; former technical director - current financial director of PD PAL Jaya, 20 January 2011; the head of Division of Wastewater, Ministry of PU, 11 February 2011; former director of Directorate of Environmental Sanitation Development, Ministry of PU, 27 January 2012

15. The draft of 2012 Master Plan has not been approved by the legislative body or given a legal status for it to be effectively implemented. However, the master plan has been referred to by several stakeholders in the sanitation development sector while several steps for its enactment have been taken.

16. The leader of Section of Method Development and Environment Management, Jakarta Cleansing Agency during a conversation with the author on 27 March 2012

17. The information was obtained during the author's interview with the leader of Section of Method Development and Environment Management, Jakarta Cleansing Agency on 27 March 2012

18. Based on the author's interview with: the section leader of Jakarta Cleansing Agency, 27 March 2012; the director of Directorate of Housing and Settlement, BAPPENAS, 5 November 2010

19. Confirmed by: the director of Directorate of Housing and Settlement, BAPPENAS, 5 November 2010; a staff of Technical Division, PD PAL Jaya, 17 January 2011

20. A project leader, Special Task Unit for Jakarta Metropolitan Area Water Infrastructure Development during a conversation with the author on 18 January 2011

21. PPSP was commenced by six pilot projects in 2006 funded by some foreign agencies within a programme called ISSDP (Indonesia Sanitation Sector Development Programme).

22. Based on the author's interview with: former staff of West Java IUIDP, 26 July 2010; the head of Division of Wastewater, Ministry of PU, 11 February 2011; former head of Division of Drinking Water and Waste Water, BAPPENAS, 7 April 2011

23. Based on the author's interview with: the director of Directorate of Housing and Settlement, BAPPENAS, 5 November 2010; the head of Division of Wastewater, Ministry of PU, 11 February 2011; former head of Division of Drinking Water and Waste Water, BAPPENAS, 7 April 2011

24. Based on the author's interview with: the head of Jakarta Bureau of City Infrastructures and Facilities, 04 November 2010; the head of Jakarta Bureau of Spatial Planning and Environment, 28 March 2012; the leader of Section of Sanitation and Pollution, Bureau of Spatial Planning and Environment, 28 March 2012

25. Based on the author's interview with: former leader of Section Wastewater, Jakarta PU, 20 January 2011; the operator of Malaka Sari Plant, 25 January 2011

26. Based on the author's interview with: the head of Jakarta Bureau of City Infrastructures and Facilities, 04 November 2010; the head of Jakarta Bureau of Spatial Planning and Environment, 28 March 2012; former leader of Section Wastewater, Jakarta PU, 20 January 2011; former director of Directorate of Environmental Sanitation Development, Ministry of PU, 27 January 2012; the member of Jakarta Regulatory Body for Drinking Water Provision, 3 November 2010

27. The member of Jakarta Regulatory Body for Drinking Water Provision during a conversation with the author on 3 November 2010

28. Based on the author's interview with: the head of Jakarta Bureau of City Infrastructures and Facilities, 04 November 2010; the head of Jakarta Bureau of Spatial Planning and Environment, 28 March 2012; the member of Jakarta Regulatory Body for Drinking Water Provision, 3 November 2010; staff of Technical Division, PD PAL Jaya, 17 January 2011; former technical director - current financial director of PD PAL Jaya, 20 January 2011

29. Based on the author's interview with: former technical director - current financial director of PD PAL Jaya, 20 January 2011; former director of Directorate of Environmental Sanitation Development, Ministry of PU, 27 January 2012

30. Based on the author's interview with: the director of Directorate of Housing and Settlement, BAPPENAS, 5 November 2010; former head of Division of Drinking Water and Waste Water, BAPPENAS, 7 April 2011; former director of Directorate of Environmental Sanitation Development, Ministry of PU, 27 January 2012

31. Based on the author's interview with: the director of Directorate of Housing and Settlement, BAPPENAS, 5 November 2010; former head of Division of Drinking Water and Waste Water, BAPPENAS, 7 April 2011; former director of Directorate of Environmental Sanitation Development, Ministry of PU, 27 January 2012; the head of Division of Wastewater, Ministry of PU, 11 February 2011

32. Former director at Directorate General of Human Settlements, Ministry of PU, during a conversation with the author on 3 November 2010

33. Based on the author's interview with: the head of Jakarta Bureau of Spatial Planning and Environment, 28 March 2012; the head of Jakarta Bureau of City Infrastructures and Facilities, 04 November 2010; leader of a section at Public Housing Agency, 27 August 2010

34. Based on the author's interview with: leader of a section at Jakarta Public Housing Agency, 27 August 2010; leader of a section at Public Housing Agency, West Jakarta Municipality, 9 January 2012

35. Based on the author's interview with the national co-ordinator and advocacy co-ordinator of KRuHA (People's Coalition for the Rights to Water) on 24 June 2011 and 18 August 2011, as well as the discussions of stakeholders meeting held by Amrta Institute of Water Literacy on 30 June 2011

36. The coordinator of FAKTA, Jakarta Citizens Forum in an interview with the author on 27 March 2012

37. Based on the author's interview with founders and an analyst of Green Building Council Indonesia on 18 November 2010 and 27 June 2011

38. Founder of *Asosiasi Toilet Indonesia* and Green Building Council Indonesia during an interview with the author on 18 November 2010

39. *Ibid.*

40. Data obtained during the author's interview with RW 06 leader, Kampung Kojan

41. These three phases were actually three successive beneficiary selection processes, but the project manager referred to them as 'phases'.

42. PUSH programme manager during an interview with the author on 1 October 2010

43. PUSH field project facilitator during a field visit on 6 August 2011

44. *op. cit.*

45. A project coordinator of Mercy Corps during an interview with the author on 26 September 2011

46. The director of Directorate of Housing and Settlement, BAPPENAS during an interview with the author on 5 November 2010

47. Based on the author's interview with: the director of Directorate of Housing and Settlement, BAPPENAS, 5 November 2010; leader of a section at Public Housing Agency, 27 August 2010

48. A project coordinator of Mercy Corps during an interview with the author on 26 September 2011

49. Based on the author's interview with PUSH programme manager and field project facilitator on 18 August 2011

50. Based on the author's interview with PUSH programme managers, field project facilitators and some beneficiaries on several occasions

51. PUSH and OWOF programme managers during an interview with the author on several occasions

52. OWOF programme manager during an interview with the author on 26 January 2012

53. Based on the author's interview with the director of Directorate of Housing and Settlement, BAPPENAS, 5 November 2010

54. Based on the author's interview with: OWOF programme manager, 26 January 2012; the chief of Kalideres cooperative, 08 November 2011

55. OWOF programme manager during an interview with the author on 26 January 2012

56. The chief and secretary of Kalideres cooperative during an interview with the author on 08 November 2011

57. Based on discussions during a community meeting in Kalideres sub-district on 21 December 2011

58. PELITA operator during a conversation with the author on 21 December 2011

59. Based on the author's interview with: a project coordinator of Mercy Corps, 26 September 2011; PELITA operator, 21 December 2011

60. Based on the author's interview with two field project facilitators of Mercy Corps on several occasions

61. Based on the author's interview with: a programme officer of Mercy Corps, 21 December 2011 and 1 February 2012; staff of Technical Division, PD PAL Jaya, 17 January 2011 and 29 March 2012; Former director of Directorate of Environmental Sanitation Development, Ministry of PU during an interview with the author on 27 January 2012

62. Based on the author's interview with: former director of Directorate of Environmental Sanitation Development, Ministry of PU, 27 January 2012; former leader of Section Wastewater, Jakarta PU, 20 January 2011; the director of Directorate of Housing and Settlement, BAPPENAS, 5 November 2010; former head of Division of Drinking Water and Waste Water, BAPPENAS, 7 April 2011

63. Based on the author's interview with: former director of Directorate of Environmental Sanitation Development, Ministry of PU, 27 January 2012; former leader of Section Wastewater, Jakarta PU, 20 January 2011; a project coordinator of Mercy Corps, 26 September 2011

64. Based on the author's interview with: PUSH field project facilitator, 18 August 2011; PELITA operator, 21 December 2011; a Mercy Corps field project facilitator, 8 April 2011

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IV.

INTEGRATING WATER MANAGEMENT AND SPATIAL PLANNING

MOVING TOWARDS

‘SOCIALLY INNOVATIVE CO-PRODUCTION’ *

Abstract

This paper argues in favour of integrating water management and spatial planning in urban development in the global South. It claims that this integration is relevant for many Southern metropolises if it addresses two fundamental issues. First, it must prioritize wastewater management, the most neglected activity within the water sector and one that should be integrated with solutions to other local community needs. Second, it should be pursued both at city and neighbourhood level. This analysis of integration is situated within the debate on social sustainability. It addresses the problems of socio-economic inequality in access to sanitation services, and failing governance in urban communities. Within the framework of strategic planning, this paper further discusses the importance of socially innovative co-production and incorporating interactive urban design projects for successful local development initiatives.

* A shorter version of this paper has been submitted to *the International Journal of Urban Sustainable Development*

1. INTRODUCTION

This paper explores the possibility of integrating water management and spatial planning. It proposes decentralized wastewater management as lynchpin of the integration processes. Wastewater management as a component of sanitation sector is crucial for eradicating poverty and improving the socio-economic productivity of households (Allen et al., 2006; Blanco et al., 2009; Whittington et al., 2012), as well as for tackling wider urban problems such as flooding and deteriorating water resources (see Novotny, 2009; Novotny & Brown, 2007). Moreover, given the failure of land-use zoning to guide spatial development (see Albrechts, 2004; Salet & Woltjer, 2009; Silver, 2008; Steinberg, 2007; Voogd, 2006; Woltjer & Al, 2007), this paper argues that wastewater management could provide a strategic focus for development processes, especially in coastal cities that are subject to increased demographic and environmental pressures, like Jakarta.

Despite the promising results experienced in the Netherlands (Hooimeijer, 2009; Meyer, 2007; Voogd, 2006; Woltjer, 2009), in reality, integrating water management and spatial planning has proved difficult at times. Indeed, 'integration' can have several meanings in the planning field. Apart from integrating two or more development sectors, many planners have struggled to combine several spatial and temporal scales, or accommodate interests and initiatives from different actors (see also Moulaert, 2000). Due to embedded conventional planning traditions and relatively inflexible institutions, the idea of 'integration' in any of these respects often remains pure jargon (see Aalbers & Van Beckhoven, 2010; Albrechts, 2004, 2012). As such, the following sections examine the factors and forces that support or impede the integration of water management and spatial planning, and which are particularly significant to the improvement of deprived neighbourhoods and the sustainability of communities, as well as in upgrading the city's overall environmental condition.

Section two explores the main forces that have led to concepts of 'integration' in and between water management and spatial planning. It shows the relevance of these concepts for urban planning in the Global South, provided that they target 'socially sustainable

communities' (Mehmood & Parra, 2013; Parra, 2013) and are deployed within a framework of strategic planning (Albrechts, 2006; Faludi, 2000).

Section three highlights the importance of *socially innovative co-production* in ensuring that local development initiatives are both successful and influential at the city-wide level. It draws specific examples from the Orangi Pilot Project, a community-driven sewerage system in Karachi. Information about this project was obtained by studying available literature.

Section four seeks to critically ground the concept of local-level, closed hydrological loop, as proposed by Novotny (2009). It discusses a direction for strategic projects, based on an urban design method and a socially innovative approach to co-production. This section highlights specific, neighbourhood-level issues that can lead to the integration of water management and spatial planning. It does this by referring to the socio-ecological challenges faced by three kampung communities in Jakarta. Fieldwork has been done in two of these three kampungs. The author and her research assistant[1] conducted interviews and observations in Kampung Kojan between May and December 2011. The author and her PhD supervisors had a one-day interactive visit to Kampung Tugu Selatan in May 2011.

2. A THEORETICAL REFLECTION

2.1. Integrated Water Management and (un)Sustainability

Increasing (greater and more frequent) problems in the water sector threaten human settlements and have thus encouraged water managers to incorporate multidimensional approaches (Novotny, 2009; Voogd, 2006). The concept of integrated water management has emerged over the last two decades, following the failure of modern infrastructures to meet today's needs and anticipate future complexities (Novotny & Brown, 2007). Integrated water management is seen as an alternative to conventional water management – which overlooks local living traditions and social capital when formulating the needs and provisions of water-related infrastructure– and supports the sustainable green city movement by promoting an infrastructure that preserves or mimics nature (Novotny, 2009).

Integrated water management is based on the understanding that highly technological solutions alone cannot meet the complexities of the urban water sector (Hooimeijer, 2009; Novotny, 2009; Voogd, 2006). Influenced by other fields of expertise, many water engineers have argued that water works should be designed as ecological and hydrological 'soft' infrastructures, instead of as highly engineered 'hard' infrastructures (see De Meulder & Shannon, 2013; Novotny, 2009). Novotny (2009) argues that one principle of the alternative approach towards water-related problems is to link micro-scale green development concepts with macro-scale watershed management through interconnected semi-autonomous water management clusters. Hence, appropriate sustainable

urban water management models must be sought at both local and regional levels. This is a progressive approach in that it requires any profession associated with the water sector to collaborate with others, to apply multi-scalar interventions.

The alternative integrated approach to water management promotes that it is necessary to accept water on land, instead of blocking it out (Priemus, 2004; Voogd, 2006; Woltjer & Al, 2007). As a consequence, local governments must allot more land for flood retention and other water projects (see Priemus, 2004). Closed hydrological loop must be created at local level, to minimize long-distance regional water and wastewater conveyance, which is a standard components of conventional, centralized water management systems (Novotny, 2009). Allocating land for water is thus an important aspect of spatial planning, but ideally, it should not be pursued at the expense of other, equally important land-use functions, such as industry, housing, agriculture and commerce (Voogd, 2006).

The concept of integrated water management has been increasingly incorporated into spatial planning processes, notably in Dutch planning practice (Voogd, 2006; Woltjer & Al, 2007). Spatial planners reckon that, in order to build a common concept of spatial quality, incorporating integrated water management can enhance spatial policy content. The planning doctrine that relies on the instrument of '"red" (built-up) and "green" (open)' areas (see Faludi, 2000) has been proven to be ineffective in structuring urban agglomerations (Salet & Woltjer, 2009). Moreover, this 'red-green' planning doctrine does not fit the context of Southern cities, which is highly characterized by sprawl and fast-growing populations. Green areas and green belts have been significantly reduced, contrary to what was laid out in the land-use plan for controlling and guiding spatial development (Steinberg, 2007).

The concept of integrated water management has indeed introduced an ecological dimension into modern spatial planning processes. However, integration of wastewater management and spatial planning processes should also cover social dimensions, not solely the delivery of physical interventions. It should also be implemented simultaneously at different spatial levels: locally (neighbourhood scale) and at higher spatial scales (see Aalbers & Van Beckhoven, 2010; Parra, 2013). In this way, the concept of integrated water management can be used to structure spatial development, but avoids path dependency on practices that impede its multidimensionality.

Making the integration concept operational implies clearing out the ambiguities of 'sustainable development', its umbrella concept. 'Sustainability' is an ambiguous concept that is widely used without being a powerful explanatory tool or an effective guiding principle for improved habitat (Cook & Swyngedouw, 2012; Swyngedouw et al., 2002). It has been conceptualized as a framework for simultaneously ensuring economic efficiency, environmental protection and social equity, but in reality development processes are never free from conflicts between these goals (see Campbell, 1996). Fundamentally, as argued by political-ecology scholars, no socio-environmental change embedded in any development process is ever socially or ecologically neutral, because certain constitutive power geometries at play, simultaneously involve both social and natural factors (see Gandy, 2004; Swyngedouw, 2006; Swyngedouw et al., 2002). *It is only when there is a clear explanation of 'who decides what needs to be sustained for whom, where, and why', that 'sustainability' becomes a powerful and useful concept* (Swyngedouw et al., 2002).

Many scholars have criticized the concept of sustainable development because it has taken for granted a socio-political order that currently causes injustice and inequality, while seeking to pursue so-called alternative development practices (Bolay, 2012; Cook & Swyngedouw, 2012; Mehmood & Parra, 2013; Parra, 2013). The concept has been translated into practices that emphasize economic and physical environmental dimensions, while overlooking the specificity of different localities and local socio-ecological needs (see Allen, 2010; Bolay, 2012; Hofmann, 2011). It has also been widely used to legitimate the commodification of technological advancement, i.e. ecologically sensitive technologies (Cook & Swyngedouw, 2012). The capitalist urbanization process sustains a certain socio-natural reproduction system that benefits certain groups within society (Swyngedouw & Heynen, 2003), and it is these groups that have been actively calling for and pursuing (their) sustainability (at the expense of others') (see Cook & Swyngedouw, 2012).

Henceforward, many scholars, including Parra (2013), Cook and Swyngedouw (2012) employ 'the social' as the centre of the analytical focus for understanding the relations between cities and the environment, instead of locating it as one (marginal) pillar of the environment-economy-society triad. Some scholars (e.g., Mehmood & Parra, 2013; Parra, 2013) elaborate the concepts of 'social sustainability' and 'social innovation' (see also Moulaert et al., 2009; Moulaert et al., 2013; Moulaert et al., 2010a) and argue that society is the fundamental engine for organizing and deciding whether or not to pursue sustainable development. The dialogue between 'social sustainability' and 'social innovation' pinpoints three interdependent objectives: 1) *the improvement of social relations, i.e. the empowerment of marginalized communities;* this is necessary in order to pursue both 2) *the satisfaction of collectively agreed basic needs*, and 3) *viable biophysical environments* (see Mehmood & Parra, 2013).

'Plural and interactive governance' (Parra, 2013, p. 149) is instrumental in moving away from unsustainable development practices towards alternatives that respond to severe socio-environmental problems. Such plural and interactive governance system is constituted by dynamic socio-ecological relations of and between territorially organized communities, improved bureaucracy, community-based organizations and socio-environmental movements that are supported by strong leadership, creative individuals and a plurality of nature-culture institutional arrangements (Ibid., 2013). This kind of governance dynamic forms the basis of what can be called 'socially innovative sustainability', i.e., continuous collective efforts to keep (re)defining commonly desired socio-ecological relationships, and to keep accumulating knowledge of innovative ways to satisfy basic needs and protect the environment (see Parra, 2013, p. 149). **Figure 1** summarizes the scope of this conceptual discussion.

However, today's fragmented societies are highly characterized by socio-economic inequalities. In this context, how can the concept of socially innovative sustainability, with its plural and interactive governance, be implemented? Should better organizational arrangements and human-to-human relationships precede the resolution of growing ecological problems? The following sub-section shows that a certain type of planning would be able to meet needs for improved social relations and thus deal with the increasing challenges of managing ecological problems and the use of natural resources. Strategic planning would enable the integration of water management and spatial planning to become more operational.

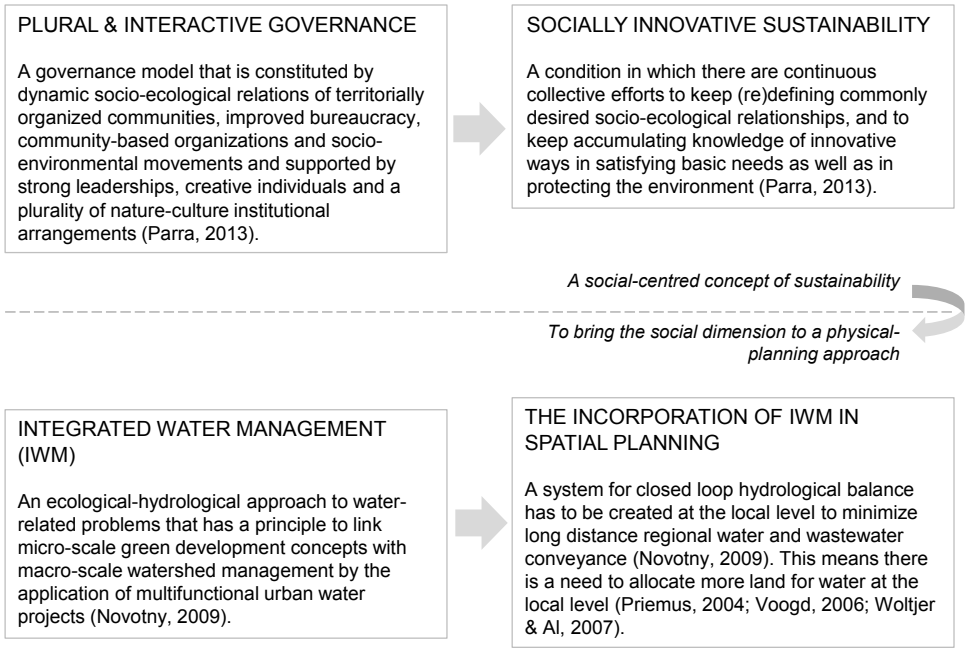

Figure 1.
The scope of the conceptual discussion

Source: the author

2.2. Strategic Spatial Planning: Paving the Path towards Social Sustainability

Many local governments in Indonesia and other developing countries are not ready to explore integrated water management/spatial development processes in a fast-changing urban environment, notably because of the inefficient bureaucracy and a lack of a long-term vision. Moreover, existing planning processes focus on land-use zoning and engineering master plans that very much rely on exclusive decision-making processes and physical infrastructures for responding to socio-ecological problems (Van den Broeck, 2004, see also Albrechts 2004 and Faludi 2000). Unfortunately, in many cases, communities are not able to initiate changes and/or push the government to include them in the planning process, nor are they ready to play a greater role in development processes because they are trapped in short-term survival strategies (see Hickey & Mohan, 2005; Simone, 2010) and also face structural and cultural barriers (Van den Broeck et al., 2004).

It seems that in such context, as has been argued by Faludi (2000) and Albrechts (2004), planning should be done strategically, leveraging a common understanding of certain issues to steer decision making processes that involve numerous stakeholders, instead of seeking to provide technocratic prescriptions only or to formulate policies without framing appropriate implementation and evaluation processes (see also Albrechts, 2006). In this paper, strategic planning refers specifically to mainstreaming integrated water management within spatial planning processes. This should then provide a frame of reference for guiding development practices in which a territory-based community can collectively define urgent 'local' needs, in relation to increasing 'global'

problems in the water sector – e.g. drought, flooding and rising sea levels. In parallel, the socio-environmental problems of wider territories should be addressed and longer-term solutions anticipated through socio-political negotiations between communities (see Allen, 2010; Hofmann, 2011; Ostrom, 1997; Parra, 2013). In this way, effective, semi-autonomous, micro socio-ecological entities can be created to deal with macro-scale watershed management, as idealized by Novotny (2009).

Allen (2003) discusses what is called 'strategic environmental planning and management', i.e. not attempting to intervene in all spheres but focusing on interventions with synergetic potential. It can be argued that wastewater management has significant synergetic potential. A decentralized wastewater management system potentially brings both inter-scalar and inter-sector synergies, benefitting both local communities and the wider city. In turn, these processes may spur on improvement in other sectors.

It is likely that the basic sanitation infrastructure needs of the lowest income groups, rural communities and inhabitants of peri-urban areas can be met by decentralizing wastewater management and applying low-cost sanitation technology (see Aguilar & De Fuentes, 2007; Allen et al., 2006; Bakker et al., 2008; Hardoy et al., 2005; Suriyachan et al., 2012). If we stick to the idea that the main goal of infrastructure development is to balance out inequalities (Beatley & Stein, 1988), then wastewater infrastructure development should be fostered to ensure public health and secure water resources for the entire city, including for the poor. The poor have been the hardest hit by deteriorating urban environmental conditions (Allen, 2010; Bolay, 2012; Hoffman, 1992); calamities such as flooding (Caljouw et al., 2005; Texier, 2008) have a potentially higher impact on their everyday health, notably because they have little or no access to basic water and sanitation services.

Informal settlements usually grow up with poor sanitary conditions, and the absence of other types of infrastructure, e.g. access roads and public open spaces, also means that spatial quality within these settlements is very low. According to a Mercy Corps study (2008), many such settlements in Jakarta are located along the river banks. Hence, addressing problems in these areas would not only improve living conditions in the neighbourhoods concerned, but also upgrade the overall spatial quality of the city. At the city-wide level, the benefits of decentralizing wastewater management include overcoming the technological bottlenecks caused by large-scale wastewater management systems; such systems have been proved inefficient for large cities in developing countries due to uncontrolled urban sprawl and a wide diversity of density levels (Mara & Alabaster, 2008; Parkinson & Tayler, 2003). At the same time, decentralization may create opportunities for the development of multi-purpose wastewater infrastructures (see Shannon & Legrand, 2007; Shannon & Nilufar, 2008; Suriyachan et al., 2012).

More fundamentally, decentralizing wastewater management means creating political space at very local levels, thereby enabling stakeholder participation in planning and decision making processes (Parkinson & Tayler, 2003). Participatory processes are necessary to resolve technological issues through consultation, and also let community members have an active role in accumulating knowledge of sustainable development practices in wastewater management. Indeed, the urban poor need more than quality water and sanitation facilities. Other needs include reliable livelihoods, entertainment opportunities, and public space in which to socialize and

build a community life. Potentially, the political space activated through a decentralized wastewater management system may be expanded to enable communities to build further institutional capital, by working collectively to meet other basic needs. Hence, decentralized wastewater management systems can play a meaningful role in enabling marginalized communities to improving their overall quality of life.

However, integrating several development sectors at neighbourhood level is a long struggle while an immediate change is desired. Strategic environmental planning and management seeks to create a balance between the formulation of long-term goals and the development of short-term interventions (Allen, 2003; Van den Broeck et al., 2004). In principle, any effort should first aim to overcome exclusion from formal decision-making processes as regards meeting basic (water and sanitation) needs; second, it should ensure the continuity of activities undertaken to go beyond meeting short-term needs (Moulaert et al., 2010a). It is vital to secure long-term commitment from and among different stakeholders. However, not all communities possess the institutional capital needed to create optimum benefit from, for example, development projects that were initiated by other stakeholders in their neighbourhood. Without institutional capital, it is difficult to turn short-term initiatives into longer-term commitments that involve various stakeholders, although leadership may be provided from outside the community. Moreover, as planners know from experience, there is no single universal formula for setting strategic priorities or selecting instruments and tools for integrating water management and spatial planning, notably by involving the local community in pursuit of social sustainability.

With the perspective of socially innovative sustainability, the following two sections discuss two key

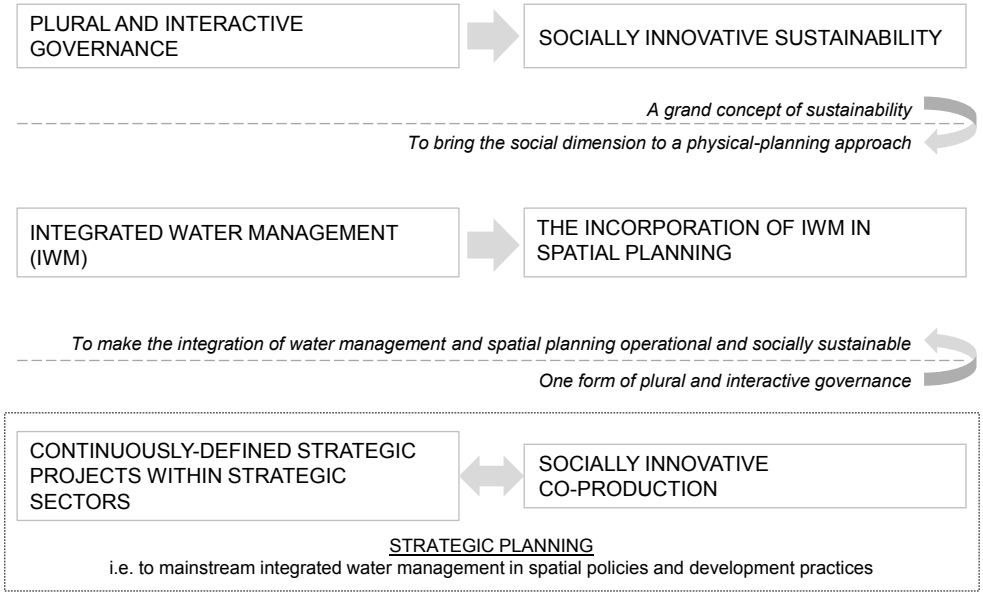

Figure 2.
Two institutional aspects of strategic planning within a plural and interactive governance system

Source: the author

institutional aspects that are essential to strategic planning: *co-production* and *strategic projects* (see **Figure 2**). To elaborate better the arguments, this paper refers to case studies from Karachi and Jakarta. These case studies exemplify the situations in which we need to ground our conceptual explorations on achieving socially innovative sustainability by integrating water management and spatial planning.

3. SOCIALLY INNOVATIVE CO-PRODUCTION FOR SUSTAINABLE LOCAL DEVELOPMENT

Albrechts (2012) suggests that planners apply a 'co-production' approach to successfully organize the open and equitable relationships between all stakeholders. Further, he explains that co-production has two different fundamental aims. First, co-production aims to reduce state expenditure and make public services more efficient by combining state and citizen-led production initiatives, with one or more elements of production being shared (Ibid., 2012). Other researchers advocate use of this model of co-production in community-based planning, collective strategy making and participatory monitoring and evaluation, to optimize the effectiveness and efficiency of development assistance (Beard & Dasgupta, 2006; Moulaert & Delvainquière, 1994; Moulaert & Leontidou, 1994).

The second aim is to create the political moments for communities to become stronger, more resilient and mutually supportive, to gain more benefits from the state and to pursue better living conditions (Albrechts, 2012); in this sense, co-production requires community members to act as active citizens instead of passive consumers of infrastructure services (see Allen et al., 2006; McFarlane, 2008). Within our frame of socially innovative sustainability (Moulaert et al., 2010b; Parra, 2013), co-production needs a certain type of institution for enabling and maintaining local initiatives within or in interaction with the wider state-regulated political system; through such institutions, these initiatives can become meaningful as democratic and transformative decision-making vehicles that help build a new citizenship (Allen, 2010; Allen et al., 2006; Hofmann, 2011; McFarlane, 2008; Moulaert et al., 2010b; Parra, 2013). In addition to overcoming exclusion from formal decision-making processes and thereby satisfying community needs and improving social relations within local communities, such local initiatives also need to become influential at the city-scale (see Moulaert, 2000; Moulaert et al., 2009; Moulaert et al., 2010a).

An active meaning of community is embedded in this concept of socially innovative co-production; community members are enablers of citizenship rights (political, social, and basic needs) while recognizing and bearing citizens' responsibilities (see also Hofmann, 2011; Moulaert et al., 2010b). The concept of an active community rejects the 'conservative' definition of 'community' as a group based on the politics of identity such as religion, ideology, profession or ethnicity (Moulaert et al., 2010b). A strong collective identity within a stable social relationship is often seen as essential for collective action (Beard & Dasgupta, 2006). In fact, as shown in many case studies, innovative collective actions have emerged within socio-culturally heterogeneous neighbourhoods ('spatialized urban communities') and

BOX 1. A perspective from Orangi, Karachi

Karachi is the only port city in Pakistan. It occupies an area equivalent to almost half of Jakarta's administrative territory. It has approximately 14 million populations (Hasan, 2008) or about as many as Jakarta's inhabitants today. This means that the average population density in Karachi is double that of Jakarta.

Orangi is a township that has been growing since 1965, when the Karachi Development Authority (KDA) began to develop 1,300 acres (~5 km^2) of land, around 16 per cent of the total area of the township (8,200 acres or ~33 km^2). It has more than one million inhabitants, many of whom live in *katchi abadis*, settlements that developed on illegally subdivided state-land (see Hasan, 2000, 2003).

In the face of badly planned and managed government development programmes and a lack of infrastructures in informal settlements, Akhtar Hameed Khan, a renowned Pakistani social scientist, took a different approach to understanding the problems of the people in Orangi and the interests of different groups and grass-roots organizations. In 1980, he negotiated an agreement with the chairman of the Bank of Commerce and Credit International (BCCI) Foundation and launched the Orangi Pilot Project (OPP) 'to develop models of community participation and local resource mobilization that could overcome the problems government programmes face in upgrading poor settlements and in poverty alleviation' (Hasan, 2003). After first identifying local organizations and activists and establishing communication with them, Hameed Khan and his colleagues and former students opened an office in the town centre and initiated Orangi Pilot Project. Four local activists were recruited as social organizers of the OPP, as it was understood that the project had to proceed independently from existing local organizations, many of which were mainly interested in lobbying political parties to make money through traditional paternalistic and patronage links (see Hasan, 2003, pp. 45-46).

The OPP identified that the need to free communities from exposure to wastewater and excreta as the most urgent issue; when the OPP was launched, lanes were full of faecal waste. At the time, existing faeces disposal practices consisted in using bucket latrines that were emptied every fifth day by scavengers, soak pits, or latrine outlets that were channelled to nearest natural drains called *nalla* (Ibid., 2003). Individual households were mainly responsible for organizing these practices. Before the OPP, there had been some joint efforts by those living near the *nallas,* but these were generally limited to addressing problems relating to flooding during the monsoon season. Furthermore, these efforts often failed because of insufficient technical knowledge (see Maskrey & Turner, 1988). One fundamental change introduced by the OPP was addressing sanitation from a collective standpoint, through a better planning process across different scales.

The OPP endorsed the formation of lane-community groups with elected coordinators (each lane consists of 20 to 40 houses). After some technical training, these coordinators organized the construction of lane sewers with community funds and voluntary labours (Hasan, 2003). Community members preferred an underground sewerage system. In many cases, they turned the natural drains into closed sewers to avoid direct contact with faecal waste, and also to gain extra surface area for public space (see pictures below). Towards the end of the 1980s, some 20,000 homes in Orangi had installed sewer lines, and the lane and neighbourhood groups had assumed responsibility for organizing maintenance processes, with further technical assistance from the OPP.

In 1983-1988, there were moments of acceleration. The OPP networks expanded rapidly and this helped replicate community-based sanitation development work (Hasan, 2000). In 1988, the OPP was upgraded into four autonomous institutions (Ibid., 2000): 1) *the Orangi Pilot Project-Research and Training Institute (OPP-RTI)*, responsible for education,

from mechanisms of crisis and recovery (Moulaert et al., 2010a; Van Dyck & Van den Broeck, 2013).

The Orangi Pilot Project (OPP) in Karachi and its spin-offs show how a local development initiative can become a city-wide co-production cycle, promoting sanitation development and more (see **Box 1**). The project possessed many essential characteristics for transforming existing community roles into long-term collective actions at local level. The development processes associated with OPP and its sequels were not without failures and lulls in innovative action. However, there were also moments of acceleration that enabled replications and network extensions at the city-wide level and beyond. Through this case study, our discussion seeks to understand the conditions needed to create a continuous co-production cycle.

'Local innovation', with a high social innovation content, is seen as the main contributor to successful sanitation development in Orangi (Hasan, 2008). It enabled low-income households to organize themselves and form lane committees to construct and maintain local sewerage systems in their lanes. With small-scale organizing, the result was a large-scale sanitation infrastructure development (Maskrey & Turner, 1988). The project was designed to allow people to manage, finance and build their infrastructure systems with technical and managerial guidance as well as credit support (Hasan, 2000).

The OPP approach can be considered as socially innovative because it applied the two pillars of sustained and meaningful local development: institutional innovation and socio-economic innovation, i.e. the satisfaction of various basic needs of local communities (Moulaert et al., 2010a; Moulaert & Nussbaumer, 2005). Institutional innovation 'includes and vehicles cultural emancipation, interpersonal and intergroup communication, preference revealing and decision-making mechanisms' (Moulaert & Nussbaumer, 2005). The OPP stimulated innovation in social relations, both within and beyond the neighbourhood level. Neighbourhood organizations were formed, and a project that was initially fuelled by progressive individuals turned into four established bodies that met different development needs in Karachi (Hasan, 2000). The OPP created and institutionalized spaces that enabled interaction between communities and urban professionals in several fields, including many reliable government officials, activists and development aid managers (see Hasan, 2000; Hasan, 2008). This helped perpetuate the OPP development initiatives. Moreover, the OPP approach to sanitation development was adopted by the city government and integrated into the development programmes of several foreign agencies; it was thus replicated across Karachi, Pakistan and abroad (Hasan, 2000; Zaidi, 2001).

The OPP introduced a component-sharing model as its sanitation infrastructure development strategy. The OPP and communities agreed on an 'internal-external' scheme for sharing costs and responsibilities between communities (internal) and the state (external). Along with the development of the lane sewers, further needs for long secondary sewers, trunk sewers and treatment plants were identified and earmarked as state responsibilities (Hasan, 2003). This sharing model complies with the first aim of 'co-production' discussed above. It was designed by Hameed Khan to ensure efficient use of public funds and development resources, as well as the effectiveness of (government) development programmes (Hasan, 2003). Sharing the responsibility for developing certain infrastructure components has a goal of its own that is overcoming many of the technical issues involved

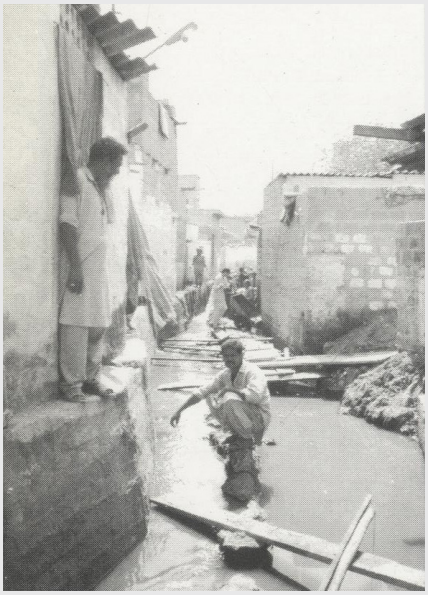

Figure A.
The natural drain before being turned into a lane sewer
Source: Orangi Pilot Project, appeared in Hasan et al. (1999)

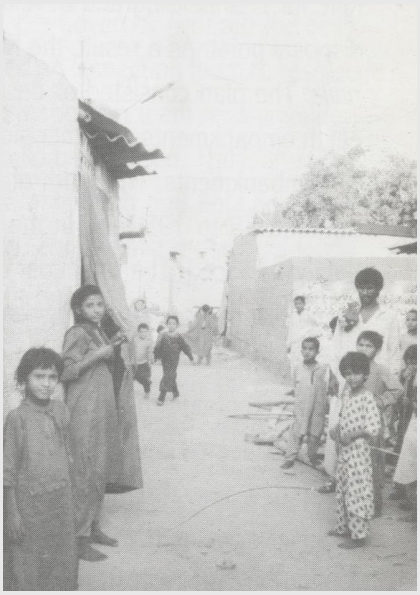

Figure B.
A lane sewer and a new public space
Source: Orangi Pilot Project, appeared in Hasan et al. (1999)

research and training in sanitation and housing provision; 2) *the Orangi Charitable Trust (OCT)*, dealing with micro credit; 3) *the Karachi Health and Social Development Association (KHASDA)*, dealing with health; 4) *the OPP Society* which channelled funds from the *Infaq* Foundation (a Pakistani charity organization) to the above three bodies. Since 1992-2000, the OPP-RTI has trained over 4,000 people in 527 groups, including the staff of NGOs, CBOs, and government agencies, as well as unemployed young people from the *katchi abadis* (Ibid., 2000). The late 1990s saw the emergence of strong neighbourhood organizations in Orangi. For example, the Ali Nagar and Ghaziabad neighbourhoods formed local committees for running schools, maintaining parks, and managing solid waste and other basic infrastructure provisions (Hasan, 2000; 2003 Appendix 10). Without local grassroots organizations and other local NGOs taking over the responsibility for mobilizing communities and providing technical support, the OPP initiative could not have continued and the sanitation development model would not have been replicated (Hasan, 2000; Pervaiz & Rahman, 2008). Today, records show that at least 7,600 lanes, comprising more than 100,000 households, are served by community-developed sewer lines; this figure represents 90 per cent of all settlements in the Orangi township, including both the formally and informally planned quarters (Pervaiz & Rahman, 2008).

The OPP's intervention included advocacy work and efforts to improve relationships between community leaders and local governmental bodies, including Orangi and Karachi Councillors (Hasan, 2003; Maskrey & Turner, 1988). This working methodology encouraged the state to provide wastewater infrastructures that needed investment and intervention that exceeded the capabilities of Orangi communities i.e. long secondary sewers, trunk sewers and treatment plants. Because many neighbourhood infrastructures had been provided by mobilizing community resources, the cost to the government of developing centralized sewerage systems decreased considerably; at the same time, the OPP challenged the earlier master plan that relied heavily on international loans to meet the high cost of conventional sewer systems that also required a longer development lead-time (Hasan, 2000; Hasan et al., 1999). The OPP-RTI continued its research into wastewater management and conducted an extensive mapping to document *katchi abadis* and city-wide existing sanitation infrastructures. It produced [engineering] plans and cost estimates for converting the Orangi *nallas* (open/natural drains) into box trunks to collect wastewater from neighbourhood sewers, channel it to the state-funded primary trunks and finally to treatment plants (Ibid., 2000).

The OPP intervention had many other spin-offs in Orangi and beyond, including improved activities of the OPP-RTI and the other three development bodies that were the legacy of the OPP. For detailed reports, consult the works of Arif Hasan (2003, 2008; Hasan et al., 1999) and others (Pervaiz & Rahman, 2008; Zaidi, 2001).

in delivering infrastructure services to underserved communities. In the case of OPP, however, it was intended as a vehicle for broader, higher-scale political participation of community groups, which is the other aim of co-production, discussed above. The project instigator saw that this kind of political participation means incorporating a long-term development agenda into the project.

It is important to note that the OPP was initiated in order to help upgrade poor settlements and alleviate poverty through four strategic issues: sanitation, health, education and employment (Ibid., 2003). Delivering lane sewers and other technological sanitation development components was not the final goal of the OPP. These were small stepping-stones for an immediate success in local development. Because sanitation was the most urgent need identified by residents, the project started by enabling low-income households to construct and maintain local sewerage systems in their lanes and neighbourhoods (Hasan, 2000). The sewers became the seed for community-empowered local development in Orangi because, through simple technologies that people could appropriate and finance themselves, the communities gained self-confidence and were able to challenge commonly exploitative local leaderships (Maskrey & Turner, 1988). Community members also challenged the existing leadership by organizing support for various *katchi abadis* community leaders who were running for local election, as this was seen a way to gain more political control over wider development processes (see Appendix 10 in Hasan, 2003).

The OPP experience shows that institutional innovation provides a foundation for the other pillar of social innovation: the social economy, i.e. satisfying the various basic needs of local communities. Basic needs include the political identity of local communities and the autonomy or self-determination of individuals, as these are essential for the long-term fulfilment of food, housing, education and health needs (see also Moulaert et al., 2009; Moulaert et al., 2010a). The Orangi experience shows that institutional innovation evolved along with a continuous identification of urgent community needs and the ways in which they could be met. This experience teaches us that, within our framework of social sustainability, the two fundamental aims of co-production are inseparable. Socially innovative co-production has the potential to widen the political participation of community groups by advocating and meeting their needs, while the state also benefits from the reduced cost of development programmes. Socially innovative co-production can also change the nature of governmental roles in development, a necessary component of on-going efforts towards better basic infrastructure services for all.

Within the frame of socially innovative co-production, there is also political space to continuously evaluate the appropriateness of a certain technological system. A local development strategy is about an issue of 'co-determination of the activities as well as the technologies they will use, that fit the characteristics of the area and of the people living there' (Moulaert & Delvainquière, 1994). However, it is also possible that evaluating the socio-technological appropriateness of an infrastructure system requires on-going collaboration between communities, to share their experience in appropriating technologies i.e. sanitary equipment and wastewater treatment infrastructures, and also between communities and professionals who have dealt with infrastructure development in various contexts. Although it may be essential to socio-technological innovation, this kind of collaboration is not easy to establish; its

institutionalization within everyday urban governance procedures requires time and commitment, as shown by the Orangi-Karachi experience.

It was actually impossible to implement a water-borne sewerage system in Karachi due to the dry climate. Nevertheless, the OPP promoted a covered sewerage system because channelling wastewater through short pipelines had become a popular practice, despite inappropriate disposal points in local open ground or water bodies. Enhancing this popular practice was seen as an effective way to organize interconnected sewerage lines on a larger scale. Culturally, community members favoured a covered sewer system due to bad associations with faecal waste. However, there were some challenges and other problems associated with implementing this community-preferred technological system.

Two years after the project began, the OPP noted that direct connections between toilet outlets and the lane sewers had caused solid material to block the flow of wastewater. It was then recommended that every household should install a one-chamber septic tank for sludge collection (Hasan, 2003; Maskrey & Turner, 1988). While this set of infrastructure technology only partially met wastewater collection needs within *katchi abadis*, end-treatment processes remained absent *at* the local level. Hence, a complete system of wastewater management *for* local communities, with a functioning lane sewer system, required community members and their leaders to maintain pressure on municipalities to ensure their political willingness to lay down connecting sewer trunks and build treatment plants at the city-wide level. In some cases, communities were also able to build secondary sewers to connect their lane sewers, but these pipelines mostly simply discharged untreated wastewater into the closest water bodies (see Hasan, 2003).

The proposal to cover many of the natural drains, the *nallas*, and thus create underground (secondary) sewer lines significantly reduced the government infrastructure development budget. Covering the *nallas* also created extra public open space for lane communities. However, over two decades after the launch of OPP, the wider public – local government agencies, local NGOs, international donors, and Karachi inhabitants beyond the *katchi abadis* – learned that this decision had serious environmental consequences. The 2006 monsoon caused extreme flooding in Karachi, and this calamity was made worse because many covered *nallas* had turned into solid waste dumping sites (Noor, 2007). The institutionalized practice of covering the *nallas* had also encouraged further settlement encroachments upon drainage areas that served as natural channels for storm water (Dehaene & Amerasinghe, 2007).

The OPP officially implemented local development initiatives in Orangi for around eight years before the initiative was turned over to the OPP-RTI, an institutional body that delivered interventions beyond Orangi. For a development project, this period is quite long and it is normally difficult to secure such commitment. Nevertheless, the experience shows that a project can never provide an overall solution to complex environmental problems. However, the OPP has endorsed many other initiatives, including setting up grassroots organizations that will hopefully be able to deal with longer-term environmental challenges. Hence, it is the role of what we have called plural and interactive governance to continuously (re)define appropriate infrastructure systems, including systems that protect the environmental resources of local communities.

4. FORMULATING SUSTAINABLE STRATEGIC PROJECTS

Many landscape and urban designers have offered alternative urban design strategies for water management that take account of problems associated with conventional modern water infrastructures: they are costly to build, and require the state to assume a strong planning, development and operating role, which it does not always do (Stokman, 2008). These approaches differ significantly from those of water engineers, who generally propose systems to create local hydrological balance in order to minimize long distance regional water and wastewater conveyance. Highly influenced by the knowledge of ecological science, landscape and urban designers seek to deal not only with the flows of water, but also of energy and materials (contaminants or nutrients), as well as transformations of these flows, through organisms within heterogeneous physical and social structures (Pickett et al., 2013b). This approach enables the diversity of viable and resilient (aquatic) biota to be restored, allowing current and future generations to live in harmony with nature (Novotny, 2009).

There have been good examples of 'soft' wastewater infrastructures incorporating 'purificative' landscape elements such as ponds and wetlands that also function as open space in dense urban environments (Shannon, 2013; Shannon & Legrand, 2007; Shannon & Nilufar, 2008; Stokman, 2008; Toshikazu, 2013). Two projects are exemplified in this paper, see **Figure 3** and **Figure 4**. In principle, this kind of infrastructure exposes water flows that were previously hidden underground or in pipes. In the context of South and East Asia in particular,

Figure 3. Constructed wetlands create green open spaces in HuaXin, Shanghai.

This was an alternative to the government's earlier plan to close the existing canals and create covered sewer lines.

Above left: May 2003. *Above right*: October 2003.

Below: Four months later, after the project was finished

Source: Ingenieurgesellschaft Janisch & Schulz mbH and Stokman (2008)

it is argued that this approach can revive traditional ways of living with water and around wetlands (Jumsai, 2009; Shannon, 2002; Shannon & Manawadu, 2007), and that knowledge of ecological water-cycle processes can be accumulated within daily interactions with the landscape (Nassauer, 2013; Stokman, 2008).

This ecological approach sees wastewater as more than a simple flow of contaminants; it also carries nutrients and other matter that make it an important source of reusable water, fertilizer, soil conditioner and energy (Massoud et al., 2009). We can see the significant roles of designers who creatively provide interactive (neighbourhood-scale) wastewater infrastructures that

Figure 4.
Above: 36 hectares of aerated lagoons surrounded by informal housing neighbourhoods along the Tan Hoa-Lo Gom canal in Ho Chi Minh City.
Below left and right: A housing project for families that were relocated to enable the canal to be widened

Source: the author (2008)

help generate additional socio-economic benefits from wastewater engineering. Alongside the problem of awareness, the affordability of sanitation devices may be an underlying issue facing sanitation developments in poor neighbourhoods. Sanitation provision is often not a priority for the households living in urban kampungs, whose income level is relatively low (see Napitupulu & Hutton, 2008).

A complete cycle of neighbourhood wastewater management enables local communities to collect effluents from basic treatment process and treat them further to produce clean water or for fish and/or vegetable aquaculture; otherwise effluents are simply discharged into (overflowing) canals and drains and mixed back into untreated wastewater. Domestic black water has significant potential for reuse in agriculture, given its low level of chemical contaminants (see Tilley et al., 2008); a pre-treatment system like a septic tank would help circumvent communities' reluctance to reuse wastewater because of sensitive social issues associated with human faeces. Moreover, faecal waste from humans and farm animals can be combined with agricultural organic waste and used as an alternative energy source i.e. biogas (Malisie, 2008).

Through dialogue, ecological scientists and landscape and urban designers have come to the understanding that the purpose of these so-called alternative infrastructures should not be to provide cosmetic ornaments *in* the city, but to form part of the greater biogeochemical processes *of* the city (Cadenasso & Pickett, 2013; Pickett et al., 2013a; Stokman, 2008). It seems that the word 'landscape' may constitute an umbrella under which urban professionals with different academic backgrounds can work together, although ecological scientists claim that the term has been used and misused in many ways (Pickett et al., 2013a).

Within the current stream of ecological research (see Cadenasso & Pickett, 2013 for the state of the art of urban ecological science) 'landscape', as *a unit of observation*, is 'a visible and noticeable artefact of often unnoticed and sometimes invisible natural [biogeochemical] and societal processes', hence, it is always subject to (unpredictable) changes; these changes include the impacts of real estate development, natural disasters, and the activities of local residents within heterogeneous ecosystems (Nassauer, 2013). Given the intangible processes that shape a landscape, and which are simultaneously transformed by the landscape's physical alterations, and also given the constant changes in knowledge owned by *the observers*, 'landscape' should be seen 'as a kind of *observation lens*' instead of as a fixed and given entity or 'spatially delimited area' (Pickett et al., 2013a).

In compliance with this dynamic definition of landscape, delineation of local governance units of wastewater management should be framed as an open decision making process, meaning that it can be reviewed within a relatively short time period after the decision is made. The spirit of dynamic landscape also calls for flexible infrastructures that can adapt as much as possible to different societal and ecological challenges and ensure resilience in the face of extreme disasters. This kind of flexibility cannot exist within centralized water and wastewater management systems that require long-term schemes to finance costly infrastructure technologies upon fixed territorial demarcations. Besides, rigid sewerage networks and water pipelines cannot incorporate the needs of heterogeneous habitats and thus protect biodiversity.

Our perspective on socially innovative co-production suggests that resilient landscapes go hand-in-hand with resilient communities, and that this inseparable

BOX 2. A perspective from Kampung Kojan: improving on-site sanitation * *

Mercy Corps worked in Kampung Kojan, Kalideres Sub-district, from May 2009 to December 2010. Through its Program of Urban Sanitation and Hygiene Promotion (PUSH), it delivered 219 technologically innovative septic tanks for treating black water. The main aim was to test and promote an alternative technology of cheap modular watertight septic tanks that meet the quality standard set by the provincial government of DKI Jakarta. In all, 35 shared latrine units were built for tenants of rental rooms. Many Betawi people in the kampung have built rental rooms on land that once was used for agriculture, to meet high demand for cheap housing for the workers. The number of rental rooms built and managed by the same owner/ operator varies; however, most are small-scale. Of the 34 landlords listed as beneficiaries of Mercy Corps, 29 own less than ten rooms.

Shared septic tanks are more efficient, and also provide an opportunity to increase the quality of shared open space between rooms and houses (see Figure C). This is because the community has to arrange pipe-connections between individual latrines and shared septic tanks. Even if there will be more individual latrines in the future, due to increased/increasing affordability and growing preferences for privacy, communal septic tanks have been available in the kampung to collect the faecal waste. A septic tank is easy to manage. If its influent increases, it can be maintained simply by increasing the frequency of hauling the sludge.

In some kampungs, Mercy Corps also initiated community enterprises to collect the sludge from septic tanks using small vehicles equipped with a low-capacity pumping system. This follow-up project added an important element to the social infrastructure, one that could become the seedbed for a collective wastewater management arrangement. Unfortunately, the community sludge hauling business unit in Kampung Kojan has not become operational because there are no facilities for storing the waste temporarily, before it can be collected by city truck haulers and transported to one of the two sludge treatment plants operated by DKI Jakarta. Low demand for sludge hauling within the community has meant than no local actors feel compelled to provide private land for this purpose.

* * *Based on the author's field research, including interviews with: two programme managers and a project coordinator of Mercy Corps, several occasions; an operator of community-managed sludge-hauling enterprise, 21 December 2011*

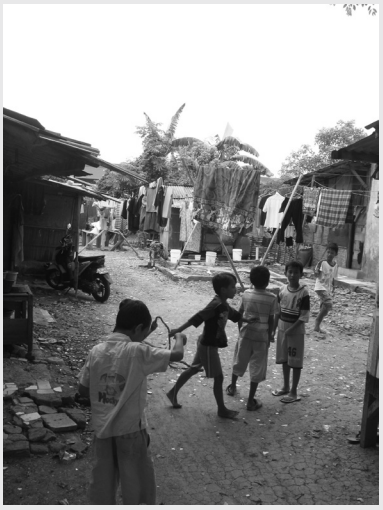

Figure C. Some rental rooms and existing open space in Kampung Kojan

(It is seen in the picture, two men are washing with water from the canal)

Source: the author, 2011

pair can be achieved only over a relatively long period. Day-to-day cooperation within the community should include dialogue between experts in different fields. The Karachi experience teaches us that successful strategic interventions do not depend entirely on the technical skills of engineers, scientists, designers and planners (see also Van den Broeck, 2004; Van den Broeck et al., 2007; Van den Broeck et al., 2004). The accumulation of knowledge about broader urban metabolism processes, through community experience with alternative wastewater infrastructures, is important for community members. This is best achieved by involving community members directly in land and water management.

The Karachi experience shows that initiatives for co-producing strategic projects should be founded on existing community practices and knowledge. Subsection 4.1. briefly discusses issues faced by communities in three of Jakarta's kampungs, as they strive to meet their basic needs. The situation in these three kampungs illustrates the interrelated development issues to be addressed by planners and designers when working towards the integration of water management and spatial planning. It seems that neighbourhood-scale strategic projects could provide the roots for bottom-up planning processes for integrated micro-macro watershed management.

4.1. Formulating Sustainable Strategic Projects at the Neighbourhood Level

Improving on-site sanitation systems has been seen as the fastest and easiest method of decentralized wastewater management in order to improve neighbourhood-wide environmental conditions (see Libralato et al., 2012; Massoud et al., 2009). Our fieldwork in Kampung Kojan indicates that, if this is the only technological option compatible with existing institutional structures, communal on-site sanitation facility is better than individual one.

Mercy Corps, an international NGO, introduced the application of improved septic tanks into the kampung (see **Box 2**). Now, the main problem faced by the community is the lack of a proper mechanism for collecting and treating the sludge. The NGO also donated two small sludge-hauling vehicles to the community, but temporary storage facilities are still needed; a certain volume of sludge is required in order for it to be economically viable for a municipal truck to transport it to the city's treatment plant. It would be more economical to install communal septic tanks, account taken of current sludge management needs and future potential to upgrade the on-site collecting system into a complete local wastewater treatment system. There are many ways to link septic tanks, as a primary treatment device, to secondary and final treatment facilities (Tilley et al., 2008). Beyond the efficiency issue, communal septic tanks or other shared faecal waste management facilities can be integrated with communal open space. Creating such multifunctional space may constitute a strategic project, helping forge the neighbourhood social relations that are needed to drive long-term collective actions for dealing with other neighbourhood problems.

The Kalideres Sub-district covers an area of nearly 500 hectares. It has a population of around 38,000 people, and includes two kampungs that are identified as slums, including Kampung Kojan. Due to growing industrial activity in this area, population density in the kampungs is likely to keep increasing. In Kalideres and surrounding sub-districts, the pace of housing estate development is also increasing, but most of the existing houses rely on individual septic tanks for faecal waste collection. As a long-term strategy, the municipality

BOX 3. Water supply and drinking water in two Jakarta kampungs * * *

Many households in Kampung Muara Baru have been connected to water networks since 2007, when GPOBA, a programme supported by the World Bank and delivered through the water companies, promoted access to piped water for poor communities with almost no connection fees (Kumar & Mugabi, 2010; Menzies & Setiono, 2010). In Kampung Kojan, the programme financed new piped-water connections while in Kampung Muara Baru, it supported 413 connections (Yudiarso, 2010). However, the author found that, in Kampung Kojan, the connected households were unable to rely solely on the piped water system − some of the new customers have even stopped using piped water − because of insufficient water supplies to this kampung. The intermittent supply is also due to low water pressure in the northern area of the network, causing difficulties in delivering water. The author has no data to evaluate the success of the GPOBA water connections in Kampung Muara Baru.

In Jakarta, access to clean water does not mean access to safe drinking water. Even piped-water is unfit to drink and still has to be treated before being consumed. Boiling water is the most widely used means of disinfecting water, although the cost is relatively high (Sima et al., 2012; Weimer, 2006). While fuel prices tend to keep increasing, other ways to provide drinking water through simple point-of-use treatment systems like chlorination and filtration are not commonly applied by individual households (see Weimer, 2006). It is expensive for the government to implement an on-going household education programme to promote alternative methods of treating water to make it potable (Sima et al., 2012).

Bottled water has thus become the most reliable source of drinking water in Jakarta. There are two main types of bottled drinking water in Jakarta. The first type is potable water produced by authorized companies. Companies fill empty registered dispenser jugs and customers can get new jugs at exchange points. Produced by big factories, this branded water distribution relies on both big vendors and petty retailers in the kampungs. The second type, 'air isi ulang' or water in containers, is provided by small local vending stations (called 'community-scale water treatment refill kiosks' by Sima et al. 2012) that emerged, prominently in Jakarta, more than ten years ago (Weimer, 2006). The containers are similar to branded dispenser jugs in form and size, but can be refilled at any of these local stations; this water costs around one third the price of the branded water.

These community water kiosks are considered profitable (Sima et al., 2012). Mercy Corps found that, in 2008, 80 per cent of the population of Kampung Muara Baru relied on drinking water from refill kiosks (Yudiarso, 2010). The author's field interviews with 14 respondents in Kampung Kojan (2011) found that six families fully rely on this source of drinking water, two families use it in addition to boiling water from the state network, and three families drink it besides boiling water from wells and mobile vendors. While the branded water complies with Ministry of Health standards, drinking water provided by community depots varies in quality, notably because it uses various water sources and treatment systems (Weimer, 2006).

Community refill kiosks normally use the state piped water or bulk-buy clean water from trucks; the latter is labelled as spring water from West Java (Ibid., 2006). These depots then purify and disinfect the water using fabricated systems: ultra-filtration followed by UV disinfection or reverse osmosis treatment (Sima et al., 2012; Weimer, 2006). Most refill stations provide a flushing system where customers can clean their containers prior to refilling (Weimer, 2006). However, it is not certain that depot owners understand how their treatment systems work, because these local entrepreneurs buy the technology from distributors (Ibid., 2006). Some local entrepreneurs do not treat the water on-site, providing local container exchange hubs only (Ibid., 2006).

Whatever the method of providing the water-refill service, this kind of community drinking water business is only the last link in a large socio-ecological cycle of drinking water provision. Clearly, the entrepreneurs cannot secure the availability of clean water as the raw material for their business. Even PALYJA, the piped water company, has difficulty securing water resources for its raw water intake. Furthermore, the decreasing quality of water resources means that the company is unable to produce clean water at a low cost. Projects of pro-poor clean water provision, in which water companies provide either individual connections (as under the GPOBA scheme) or single meters for collective connections that serve groups of households within slum community (widely known as 'master meter'), basically only address issues of how to transport water and manage customers and their payments. These initiatives do not solve the problem of limited water resources in the city and/or necessarily increase the affordability of market-controlled water services.

** * * Based on the author's case-study research, including interviews with: a manager of GPOBA-Palyja, 08 November 2010; an engineer of PALYJA, a water company operating in Jakarta, 10 November 2010; advocacy coordinator of KRuHA, a local NGO advocating the rights to water, 24 June 2014*

needs to provide decentralized wastewater treatment plants at sub-district level. Aerated lagoons or wetlands for wastewater treatment can be built as temporary infrastructures, optimizing nearby vacant land, pending future industrial developments. For a reference, the Tan Hoa-Lo Gom aerated lagoon in Ho Chi Minh City, built over a ten-year period, covers around 33 hectares and can treat the wastewater generated by up to 200,000 people (Le Dieu et al., 2007). The size of this lagoon might not fit the Kalideres Sub-district, in which the government system is not strong enough to secure such a large area of land. Hence, it may be better to have several wastewater treatment facilities located in different places across the sub-district. As such, they can be tailored to both the availability of land and changing community needs for wastewater infrastructures. One unit can serve one kampung, or be shared between kampungs and/or housing estates.

It is often difficult to convince policy makers and community leaders of the importance of decentralized wastewater management. However, it is also increasingly difficult to ignore the relationship between wastewater management and clean water provision at local level, as experienced by the communities of Kampung Kojan and Muara Baru (see **Box 3**). It may be good development practice to emphasize the importance of decentralized water provision in securing water resources at local level, but this must be combined with proper local-level wastewater management and rainwater harvesting (see for example Toshikazu, 2013). All community members require clean water, but availability is often a problem. Thus, developing programmes for securing local water sources alongside decentralized wastewater management would garner further support for local wastewater infrastructure development.

Despite the increasingly obvious lack of water sources for domestic needs in Jakarta, projects aiming to secure water resources are rarely implemented at the neighbourhood level. Planning officials in Jakarta generally argue that securing water resources needs intensive capital investment and planning processes that cover the entire watershed.[2] This approach often leads to water resources being secured by solutions that rely on large-scale dams. However, this approach implies a risk of conflict between city needs and the needs of local communities. Similar issues are also raised as regards flood management, if planning for flood retention infrastructures are addressed at watershed level only.

Considering that flood canals alone cannot keep Jakarta dry, policy makers began to consider the approach of giving more space to water in the city by revitalizing the existing water retention areas.[3] Two reservoirs have been dredged and the embankments have been designed for new public space with parks and civic amenities, including an opera house.[4] Unfortunately, the reservoir revitalizations will cause the eviction of thousands slum-dwellers who have lived in their settlements at least for two generations. Conflict of this kind is apparent in the on-going project to upgrade Pluit Dam, a dam that was built for flood retention.

Kampung Muara Baru has been growing for decades, encroaching on state lands and the dam. Most of the houses are considered illegal. However, official water pipelines were laid in the kampung around six years ago, regularizing many existing illegal connections. Before the piped-water supply programme came into operation, the previous governor of DKI Jakarta (Fauzi Bowo, 2007-12) had signed an agreement with the water company that the inhabitants of the illegal settlement would not be evicted.[5] However, despite this formal investment, and in an ironic

twist of fate, communities in this kampung have now been threatened with eviction due to the dam revitalization project. By late 2013, as many as 1,700 households had been evicted, and thousands more are slated for relocation.[6] Sadly, last year, the government only managed to re-house 300 households in the newly built high-rise social housing blocks of Pluit.

Figure 5 shows the cleared dam embankment that is now used as public open space. This new urban landmark has been portrayed as a successful development project in the mass media. Indeed, Jakarta residents have long wanted more public open space, and the new square is greatly appreciated by local residents.

In Kampung Tugu Selatan, community groups have collectively constructed small-scale gardens in their alleys, producing various types of herbs, vegetables, fruits and fish for local consumption (see **Figure 6**). The level of social cohesiveness in this kampung is exceptional compared to the other kampungs discussed in this paper. Community members and leaders were motivated to seek assistance from outside as well as contributions from within the community, to keep pursuing a better living environment (see **Box 4**). The process of developing communal gardens strengthened the feeling of belonging to the same community.[7]

Despite all these visible improvements, Tugu Selatan still has no proper wastewater management system. Special intervention appears necessary to introduce technological systems that would allow wastewater in this kampung to be reclaimed, e.g. for the gardens and fishing ponds. Moreover, Kampung Tugu Selatan has to face an additional problem: drains are often blocked and, according to the community leader, this is because the surroundings of the kampung are at a higher altitude. These neighbourhoods are thus at risk of flooding during extreme calamities. This is a more serious problem, requiring a larger-scale approach to water management that is beyond the capability of the community.

Figure 5. A new park around the Pluit Dam
Source: courtesy of Gombang Cengka, 2014

Figure 6. A community garden in RW 2, Tugu Selatan Sub-district
Source: the author, 2011

Figure D. A green alley in Tugu Selatan

Source: Author, 2011

BOX 4. A perspective from Kampung Tugu Selatan, Jakarta: waste management and community gardens****

The community in Kampung Tugu Selatan (consists of five RW) suffered from the extreme flooding that hit Jakarta in 2002. After being categorized as a 'slum' community, from 2005 to 2008, this kampung was included in the 'Program Perbaikan Kampung Terpadu' (Integrated Program for Kampung Improvement – a variant of the Kampung Improvement Program first introduced in 1969) administered by the Public Housing Agency of North Jakarta Municipality. Many officials confirm that this neighbourhood has been greatly upgraded, and has continued improving even after the programme was concluded.

Towards the end of 2009, the governor of DKI Jakarta made an official visit to a programme called 'Rumah Sehat' (Healthy House). When the visiting team passed through a vacant plot in RW 2 that had been used for solid waste dumping, it was suggested that this land could be developed as a community garden. Work on this project began in January 2011 and, by the author's visit in May 2011, the land had been

Figure F. Murals along a green alley in Tugu Selatan, panacea for blocked drainages?

Source: Author, 2011

turned into a beautiful green open space, producing various types of herbs, vegetables, fruit and fish for local consumption.

Without constantly mobilizing local labour power, the community would have been unable to deal with the large volume of garbage and make space for cultivation. After several attempts using simple tools, community members finally decided that it would require too much time and energy to remove all layers of solid waste; instead, they added a new layer of soil on top of the garbage pile. While most of the construction materials were provided by community members, seeds and young plantations were donated by the national government. The land is actually owned privately, and an agreement was reached that allowed for its public use.

Apparently the crises caused by regular flooding in Jakarta encouraged the community to address their solid waste management. Using this vacant land for a community garden has been effective in preventing garbage dumping in Tugu Selatan. The community garden model has been replicated in other units of RW. RW 2 even has another communal garden, also created on previously unused land. Other activities also address solid waste management: there is a project of 'one composter for every ten houses', while some women's groups produce crafts from plastic waste.

Tugu Selatan is touted as a successful example of the most recent version of Kampung Improvement Program (hereafter KIP) in Jakarta; it is the pride of both the local government and community members. Nevertheless, there was nothing particularly extraordinary about the four-year KIP in Tugu Selatan. In many other places, including in Kampung Kojan where the modular septic tanks were introduced, similar interventions have also been implemented, notably to build drains and roads, as well as wells to promote artificial groundwater recharge and to reduce surface runoff. Earlier generations of KIP, notably in 1969-79, also delivered this kind of physical development, but various particularities specific to Tugu Selatan led to on-going development practice.

Community members and leaders were highly motivated during the four-year KIP project. Learning from that experience, the community has actively sought assistance from outside as well as contributions from within the community, to keep pursuing a better living environment. During KIP, an organization called 'Masyarakat Peduli Lingkungan' (hereafter MPL) was formed in the kampung, and later partnered the sub-district government on some other development initiatives. MPL's leader encouraged community members to create a common vision of their neighbourhoods, defining eco-tourism activities within the kampung. Apparently, it is this vision that encouraged community residents to continue playing an active part in development processes. Developing the community garden strengthened the feeling of belonging to a shared community.

This community includes many pensioners who actively dedicate themselves to community activities. As former blue-collar workers or military personnel, they are the most educated inhabitants within their age group; from the author's observation, they seem to be quite influential within the local political constellation. Some of them own rooms that they rent out to factory workers working in the surrounding industrial sites.

The kampung is dominated by houses with rental rooms. The presence of many neighbourhood green spaces makes this type of worker housing appear more comfortable than that offered in Kampung Kojan, despite the higher population density in many areas of Tugu Selatan. The author had no opportunity to research water and sanitation conditions in these neighbourhoods, but it is likely that these houses have sufficient room inside to accommodate domestic activities such as washing and cleaning, and have individual accesses to water sources. While alleys in Kampung Kojan are often occupied by laundry-related activities, alleys in Kampung Tugu Selatan are decorated with greeneries (see **Figure D**).

The environment of Kampung Tugu Selatan contrasts strongly with that of the adjacent Tanah Merah neighbourhood. The latter is perhaps as old as Kampung Tugu Selatan, but the kampung was only recognized by the government in 2012, providing community members with the official address they need for their identity cards (*The Jakarta Post* 6 November, 2012). Clearly, legal status is fundamental to the willingness of community members to improve their environment (see also Winayanti & Lang, 2004).

Apart from the social composition of the community that allow many collective initiatives from within the community, on-going environmental quality improvement in Kampung Tugu Selatan is also driven by many other joint initiatives from the government, private sector and NGOs channelled to Tugu Selatan Sub-district. Indeed, the initial success attracted other initiatives. The national government has even acknowledged the kampung's contribution to restoring green spaces to the city. Mercy Corps has also worked in this kampung, improving sanitary behaviour and children's nutrition. A project funded by a paint company enabled the community to create murals along the main alley (see **Figure F**), and this artistic project has also lifted the pride of the inhabitants.

**** *Mainly based on the author's field visit on 19 May 2011*

5. CONCLUSION

This paper demonstrates that the path towards sustainable water and environment management is built on resilient neighbourhood governance system, in which community members are actively involved in the continuous process of defining their needs and identifying collective responses. Such local resilience both requires and forms an integral part of plural urban governance systems, which bring together creative thinkers, progressive local leaders, committed civil servants, NGOs, private sector stakeholders and members of broader civil society organizations. Such plural governance systems are typical of successful strategic planning.

The empirical analysis is based on three Jakarta kampungs and complementary examples from Karachi. It shows, first, that diverse initiatives exist to promote decentralized water management. Second, it shows that decentralized wastewater management is a primary factor in neighbourhood place-making processes, through which daily social relations can be improved. Spatial solutions for wastewater treatment facilities can open up opportunities for the creation of communal space, which is lacking in many big cities of the Global South. Third, the empirical reviews suggest that different water and sanitation development initiatives in a city or region need to be glued together in an integrated local development approach that links at least two scales of spatial planning (city or metropolitan area and neighbourhood).

Our discussion has highlighted conditions under which urban populations can act as active communities, controlling their everyday environments in ways that improve the wellbeing of community members. We learned from a critical analysis of the case studies that restoring local hydrological balance – for meeting basic water and sanitation services needs together – is a key first step towards simultaneously meeting other community needs, such as green open space, and improving the sustainability of the city's socio-ecological system. This socially innovative approach to development essentially advocates the inclusion of communities that have previously been excluded from the policy-making processes, providing them with the resources to improve their micro water system.

Jakarta's urban kampungs and Karachi's katchi abadis have experienced long-term exclusion from formal development processes, and this has trapped current neighbourhood communities in a cycle of further exclusion from development. One characteristic of disintegrated localities is the absence of spatial cohesiveness (Moulaert & Delvainquière, 1994). This paper argues that overcoming spatial segregation helps address the problems of disintegrated communities. It has discussed how the appropriation of wastewater treatment infrastructures helps engineer the socio-ecological landscape, improving social interactions within and between territorial communities as well as between communities and local government agencies. This is one way to disconnect communities from the cycle of exclusion from development.

The paper explains that a neighbourhood should no longer be seen as merely a site of service consumption. Instead, it should constitute a site for coordinating and deploying collective actions to meet basic needs, simultaneously challenging governmental bodies to keep driving innovative action against socio-environmental injustice. Combined, these actions can lead to the creation of an autonomous micro socio-ecological system that is crucial to supporting the macro socio-hydrological balance of the city and beyond. Such local community contributions to the city's wellbeing will legitimate their rights to continue seeking sustainability in the city, while becoming politically empowered in facing the expansive

market-led spatial development.

This paper does not only cover success stories. It also identifies potential obstacles to further progress in searching for a better local habitat. These obstacles include a lack of community involvement, the practices of a conventional and bureaucratic governmental system, and inadequate stakeholder knowledge of good socio-technological systems for water management. Neighbourhoods are at the crossroads of networking dynamics involving a range of organizations, from NGOs to local governmental bodies. Increasing community capacities to pursue sustainable development means improving their networking dynamics, and thereby achieving a more socially-innovative sustainability. Communities with a history of collective action may be more successful than others in keeping closed water-cycle in their neighbourhoods for community hydrological balance.

Jakarta's spatial planning agenda should include the creation of new collective spaces that enable 'socially-innovative co-production' to grow. Spatial planning processes should be steered towards creating a better water management system in metropolitan Jakarta and beyond. Our discussion of three complementary cases in Jakarta suggests that the integration of water management and spatial planning is effective in building sustainable community development, and should begin at the local level. In order to ensure effective opportunities for future integration, it is essential to build-in connections to the city-wide network of sanitation services by providing local collection points, recycling equipment and clean water provision systems. To this purpose, the empowerment of the district/sub-district government tier is essential to promoting co-production processes within and across neighbourhoods, and at the city-wide level. The role of higher-level governmental bodies cannot be overlooked when addressing the wider development problems associated with deteriorating environmental conditions at the river-basin scale as well as fragmented development and the fragilization of informal settlements and working-class housing.

It is a long journey to arrive at a performing and coherent planning and management system at the local level, supported by an effective coordination mechanism at higher levels of governance and integrated sector-policies. This paper has indicated some fundamental issues at the neighbourhood level that must be addressed strategically by community leaders, policy makers, planners and designers, if better environmental sanitation in particular and improved spatial quality in general are to be achieved at the local level and beyond. These issues are fundamental, because they relate to basic needs for water, sanitation and public open space. Thus, addressing these issues may drive further, lasting state-community collaboration, involving dynamic plural governance systems. Indeed, mutually-interdependent state and community-led initiatives keep the social engine of collective action functioning (see also Ostrom, 1996; Ostrom, 1997 p. 29-57).

NOTES

1 Setiaji Wibowo, a final-year undergraduate student with the Department of Political Science, University of Indonesia

2 Based on author's interviews with: an engineer of PALYJA, a water company operating in Jakarta, 10 November 2010; the head of Division of Wastewater, Ministry of Public Works, 11 February 2011

3 *The Jakarta Post* 14 May and 30 September 2013

4 *The Jakarta Post* 22 June, 16 and 20 August 2013

5 A manager of GPOBA-Palyja, a programme promoting water connections for the urban poor, in conversation with the author on 08 November 2010

6 FAKTA, a local NGO, in personal communication with the author, December 2013

7 A community leader in Kampung Tugu Selatan, in a conversation with the author on 19 May 2011

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B.

THE KAMPUNGS AND A NEW ENVIRONMENTAL CITIZENSHIP

GENERAL CONCLUSION

This PhD research makes an original contribution to addressing social and environmental questions in the field of urban water management within rapidly transforming cities of the Global South. It focuses specifically on the importance of wastewater management in improving sanitary conditions and overall community wellbeing in deprived neighbourhoods, as well as for ensuring the viability of existing water resources in the city. It argues that wastewater management is a key development component in addressing the pressing problems of population growth, extreme climate events and worsening environmental problems in cities of the Global South. The empirical study of Jakarta's development trajectory offered some important insights into the everyday politics of wastewater management. The study cuts across different territorial scales: the housing unit, neighbourhood, district, city, and metropolitan levels. The focus and contents of the four papers contained herein have been summarized in the general introduction. In this general conclusion, I will not repeat these summaries, but will highlight the main contributions and further elaborate on them in the following sections.

One fundamental contribution of this PhD research has been to provide a critical understanding of contemporary sanitation infrastructure development processes in relation to uneven economic development. It deems the latter to be the result of several (on-going) economic restructuring processes involving (global) firms as well as enterprises and households

from the informal sector. The research revealed the complex connection between formal and informal institutionalization processes in the water and sanitation sector, within a multi-stage historical transformation, and analysed the roles of state agencies, private sector firms and civil society agents in these institutionalization processes. Parallel institutionalization processes, as regards both state/market regularization and (community) informalization, as well as the interplays across them, have been driving the reproduction of intra- and inter-neighbourhood disparities in basic sanitation infrastructure services. Embedded within on-going institutionalization processes and different territorial dynamics, diverse water and sanitation services do not perform as a coherent ensemble of city-wide infrastructures, but grow with varying quality, embody social exclusivity, and often become territorially conflictive.

This PhD research is also relevant in its approach to analysing future development strategies. The research has sought to understand popular community practices adapted to meet basic sanitation needs, their development trajectories and their interplays with the government sanitation development model, which focused predominantly on matching the spatial development practices driven by the corporate sector, rather than meeting the needs of kampung communities. Many of the community practices can be improved and serve as a basis for better models of water and sanitation services with community self-management. A universal right to water and sanitation does not necessarily require a uniform way of providing and accessing these services through standardized technological systems. In fact, the existing water and sanitation provision systems have offered opportunities for applying a variety of decentralized modes of service provision within a city-wide integrated water management system. This PhD research has advocated the need for flexible policy-making and governance processes for multiple, but integrated, provision and administration systems for the water sanitation infrastructure.

Having mentioned the contribution of this PhD research to analysing the current dynamics and guiding future interventions in the urban water sector, this conclusion seeks to further elaborate these issues under three inter-related topics. I argue that 1) there is a need to disconnect communities from unjust socio-ecological relations in the production of nature; 2) decentralized wastewater management has the potential to unlock better socio-ecological relationships and drive a move towards a more democratic production of nature; and 3) strategic spatial planning has a role to guide the realization of common imaginations as regards spatial quality within the new way of producing nature.

1. UNRAVELLING AND DISCONNECTING UNJUST SOCIO-ECOLOGICAL RELATIONS TODAY

This PhD research has revealed the intertwining dynamics between the water cycle and everyday politics and praxis. Certain practices grew out of, and in the same time consolidate, the prevailing modern rationalities of water management, while others resist or oppose these rationalities. The use and disposal of (waste) water, of varying quality and quantity, within diverse institutional arrangements, is an integral element of the multiple historical trajectories of a city, a district, a kampung and their communities. Channelling, diverting, purifying or tapping water involves certain valuation and negotiation practices that are dictated by power and influence, as water cycle management is necessary for sustaining different community (re) productive systems, under capitalist social relations or beyond (Gandy, 1999, 2008; Jewitt, 2011; Lansing & de Vet, 2012; Loftus & Ekers, 2008; McFarlane, 2012; Swyngedouw, 1999; Swyngedouw et al., 2002). Even assuming that there is enough fresh water on earth for the entire population, the main issue is how to govern its allocation in order to ensure that everyone has access to clean water (Loftus, 2009b).

Ensuring access to water has been a major concern of all Jakarta's successive governments since the colonial times (see Paper 2 and 3). But 'water for all' and 'public health for all' remain real challenges. Market-oriented development agendas have been serving higher-income consumers in areas with key economic activities, favouring standardized modern technologies and institutions. In addition to facing several uncertainties related to the future of their settlements and jobs, many communities in kampungs have poor access to water and sanitation, and certainly do not have the capabilities to tackle overall environmental sanitation problems.

In resonance with Chatterjee (2004), this PhD research has shown how poor residents become a non-part of the imagined universal collective domain of the 'modern' provision-consumption system in which the state grants equal rights to all citizens. Fulfilling their very basic needs requires them to perform certain political practices, 'the politics of the governed', within a different political domain (Ibid., 2004). This other political domain, however, is not fully situated outside the state administrative system, because many state apparatuses are still involved. This PhD research has shown that the political domain of kampung residents relies on an extensive network with many different facets of informality. Empirical findings regarding territorial dynamics in the kampungs have challenged the notion of modern citizenship that is based on a single model of 'the individual', and in which it is assumed that all humans are fully rational agents operating in the dichotomous state-market world (following Ostrom, 2010). Yet,

despite being meaningful, many of the institutional dynamics that exist beyond the state and market are not yet capable of empowering those who have been marginalized and excluded from better water and sanitation services, or enabling them to access quality service provision (see Paper 1 and 4).

The developmental trajectory of the water and environmental sanitation sector in Jakarta has been characterized by interwoven discourses, ideas and norms that straddle both modern and pre-modern conceptions of urban form (see Gandy, 1999, 2006; Kaika & Swyngedouw, 2000), different modes of economic production and their associated modes of social, political and economic integration, as well as a diversity of work-types and income structures at the household level (see Harvey, 1973; Harvey, 1985, 2005; Mingione, 1991, 2002). The development of the port town of Batavia and subsequent efforts to modernize the colonial capital city had implications for the reorganization of indigenous kampungs and life in those communities. However, the kampungs perpetuate the use of wells, soak pits and porous septic tanks associated with agricultural communities and rural settlements, instead of being fully developed with proper water and sanitation service provisions, according to the modernist ideals. Furthermore, this modernist urban vision did not make kampungs or their socio-ecological dynamics disappear from the urban landscape of Jakarta, or cause them to be entirely been replaced by the villa housing estates and high-rise apartments produced by the formal state-led spatial planning system. Interestingly, wastewater management in spatial enclaves beyond the kampungs also do not utterly manifest the modernist idealization of collective provision systems that are organized by the state and/or through the markets, typified by centralized pipe networks that bring drinking water into homes and channel wastewater away from the city. In fact, several types of service provision system operate throughout Jakarta, incorporating different, yet connected, networks of economic exchange as well as varying types and quality of water infrastructure devices.

Perhaps the modernist vision of a perfect city, supported by the advancement of science and technology and equipped with massive engineering works, will always be implemented partially, or even remain pure utopia (Gandy, 1999, 2008). Indeed, this proviso does not only apply to cities of the so-called Global South, in which the capacity and knowledge of the government may be seen as lacking while bureaucratic corruption is endemic. Many cities in the first industrialized countries, from which the conception of the modern city has spread and evolved, have always applied other sanitation infrastructure models in addition to what we now define as the centralized system. The early 19th century Haussmann project, which aimed to drive modernization through the development of magnificent sewer networks, among other things, had to face several contestations before it

became the sewer model that we recognize today as for transporting grey and black water (see Gandy, 1999). Originally, the Haussmann sewer system model was designed to convey storm water only. For a relatively long time, wastewater in Paris was managed by the centralized sewer operated alongside the extensive service networks of 'night-soil collectors' who removed faecal waste from individual houses (see Ibid., 1999). Up to this day, Venice and many other Italian cities have for long been relying on small-scale decentralized wastewater treatment systems, including the use of septic tanks (Libralato et al., 2012).

Nevertheless, the actual presence of the modern city as a social and cultural hybrid reaches beyond the physical span of its infrastructural networks and tangible material metabolism processes. The modern city occupies the 'mental landscape' of its inhabitants (see Gandy, 1999, 2004; Loftus, 2009a; Loftus & Ekers, 2008), of the government apparatus, and of households living in modern housing delivered by private developers. The concept of modern housing tends to dominate the reality of other forms of urban settlement populated by subordinate groups within society. The centralized sewerage system currently covers only two per cent of the Jakarta area, but modern wastewater management has been idealized, embedded within the day-to-day bureaucratic activities through different state institutionalization

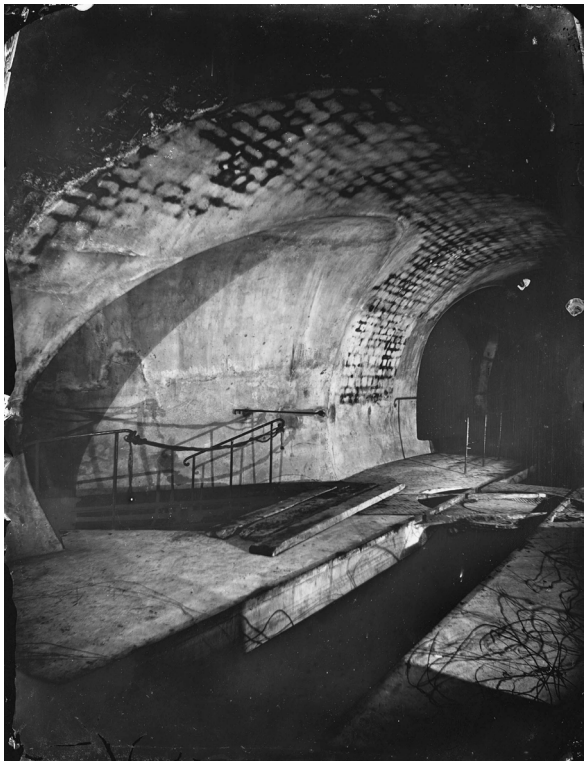

Figure 1. The Paris Sewer, photographed by Felix Nadar
Source: appeared in Gandy (1999)

processes. Although development of the centralized sewerage system had been very slow, the government kept its efforts focused on expanding the centralized sewerage system, without incorporating the possibility of improving the diverse practices deployed within communities in meeting their water and sanitation needs (Paper 3). Many development actors believe that the urban ideals of advanced industrialized countries, both the institutional and technological models, would drive urban development forward, because this accepted 'common-sense' view has been continuously repeated and amplified by officials in various tiers of government, international organizations, consultancy firms and other corporate enterprises, through their articulations within varying master-planning processes.

The 1980s and 1990s saw substantial development of piped-water infrastructures, underground sewers and large-scale wastewater treatment plants in many Indonesian cities (see Chapter A, the general introduction). Despite being present in different forms since the canalization of Old Batavia, this type of modern water infrastructure established the prevailing concept of the modern city. The colonial conception of urban form comprised a principle of highly regulated water flows administered through various state institutions, which were created to support colonial economic activities (Paper 2). Post-colonial governments have taken many colonial administrative institutions for granted, adopted them and continued to apply the outdated task-divisions within the Public Works, Public Health, Spatial Planning and Housing agencies (both at provincial and municipal levels) (Paper 2 and 3); as consequence, up to this day, many development works have often been incoherent and fragmented at and across different development intervention scales. This kind of administering procedures means that the government will not be able to effectively respond to the highly heterogeneous nature of kampung communities; instead, by following market-driven development agendas, it continues increasing the urban fragmentation inherited from preceding colonial and pre-colonial regimes, which favoured exclusive spatial development.

This PhD research has enhanced the understanding that everyday environments, including the production, use and appropriation of modern water infrastructures, consolidate the hegemonic power relations that maintain unequal access to water, sanitation and healthy environments in the city (see Loftus, 2009a; Loftus & Ekers, 2008). Loftus and Ekers (2008) have argued that daily hydraulic practices are 'being imbricated in the operation of hegemony and in the maintenance of subtle forms of rule' (p. 698). Such hegemony is also consolidated outside state institutions. In the case of Jakarta's kampungs, this research found that there is a mix of feudalistic and capitalistic socio-cultural institutions structuring relations between tenants and land owners, factory workers and petty traders, kampung communities and surrounding housing estates, and others, in addition to the industrial economic relations of

production and their associative institutions e.g. workers-firms, workers-unions, the state-entrepreneurs, finance-industry (following Mingione, 1991). Together, these reproduce a cycle of poverty, poor sanitary conditions, and low income levels. Moreover, as has been argued by (Gramscian) political ecologists, not all the power relations that lie behind the discriminating production of nature, the city and, in part, the everyday socio-ecological environment of a neighbourhood, are consolidated through coercion (e.g. intimidation, evictions and land grabbing) and within a visible time dimension; it is the essence of 'hegemony' that it also involves 'soft' forms of power enactment inherited from generation to generation, reproducing a series of social relations concerning class, gender, ethnicity, community practice through (water) culture, built infrastructures, scholarly thoughts, policy studies and governance systems that matter for the survival of capitalism, despite its contradictions (see Cook & Swyngedouw, 2012; Ekers et al., 2009; Loftus, 2009a; Loftus & Ekers, 2008; Mann, 2009; Swyngedouw, 2004a).

My field work on the contemporary conditions and history of Jakarta's kampungs has shown how large-scale market players have directly and indirectly influenced the fragmented patterns of water consumption and sanitation provision, as well as the expansion and densification of informal settlements in the urban area. The dominance of water and sanitation services provided by the state and/or big water enterprises, for example, is not necessarily a result of direct-pressurizing people to connect to the services. Long-standing asymmetric institutionalization processes have caused market-led strategies to penetrate the highly permeable membranes of the 'productive' and 'reproductive' spheres of the informal economy in many communities, especially in the kampungs (Paper 1). Traditional wells and soak pits do not function properly anymore due to the highly densified urban settlements, and it has been strongly argued, often persuasively through cultural campaigns, that they need to be replaced by modern infrastructure facilities that, unfortunately, are more commercialized and expensive relative to the incomes of most of kampung residents.

Yet analysing the phenomena of water sanitation and provision at neighbourhood level has led me to conclude that community water and sanitation services form part of the extensive reciprocity networks, employed to sustain household (re)production in the kampungs. Kampungs are the home of low-paid workers employed by the surrounding factories and other industrial activities. They are also hubs of the low-cost domestic services, such as cleaning, washing and cooking, demanded by residents of the adjacent middle-class housing estates. Unfortunately, institutional hybridization in a capitalist-minded society has put pressure on many types of reciprocal relations, which constitute the foundation of informality (Paper 1). At the same time, the different facets of informality reproduced within households and

neighbourhoods contribute to capital accumulation by private firms, either by inter-mediating the consumption of bottled water or the monopoly of services provided by the state and/or big water enterprises, or by continuing unsustainable water management practices (Paper 1 and 4).

If it is the everyday social relations that maintain the hegemonic production of (hydraulic) nature, then, particular social relations embedded in the daily operations of conventional water infrastructures that impede an active role of community members in meeting their needs, have to be replaced by building a new socio-cultural system, a more democratic system of the (re)production of nature (following Loftus, 2009a). Power circulates through 'conduits' that are anchored in several governmental institutions, and this mechanism has benefitted certain population groups while excluding others (Loftus & Ekers, 2008; Swyngedouw, 2004b; Swyngedouw et al., 2002). If a new socio-natural model were to be created, cutting off these conduits would also disconnect communities from the cycle of exclusion from development, provided that new conduits are opened up to enable the creation of new collective space in which what I call 'socially-innovative co-production' can grow (Paper 4). Indeed, the new ecological consciousness needed as the basis for struggles against hegemonic social relations should stem from existing practices (Loftus, 2009a). I argue that this can be done through emancipatory development projects (see Paper 4).

In contrast to hegemonic projects, good strategic infrastructure projects should be able to mediate, create or maintain the institutions needed to enable and sustain local initiatives within or in interaction with the wider state-regulated political system (Paper 4). Socially innovative strategic projects would allow local initiatives to become meaningful vehicles for democratic and transformative decision-making, working towards new citizenship (see also Allen, 2010; Allen et al., 2006; Hofmann, 2011; McFarlane, 2008; Moulaert et al., 2010; Parra, 2013). This PhD research has shown how decentralized wastewater management creates opportunities for co-producing socially-innovative strategic projects. Below, I enhance this argument by showing how central wastewater management is to facilitate a new, non-hegemonic production of nature.

2. DECENTRALIZED WASTEWATER MANAGEMENT AND THE NEW PRODUCTION OF NATURE

This PhD research suggests that deploying decentralized wastewater management systems in Jakarta would help provincial and municipal governments respond to the various sanitation problems that exist within the heterogeneous urban environment, notably by incorporating and optimizing the multiple roles of different development actors beyond the state. One fundamental characteristic of a decentralized wastewater management system is that it covers a relatively small service area, allowing an optimum distance of wastewater conveyance from where it is generated, as well as many ways to benefit from the recycled water and other nutrients carried in it (Libralato et al., 2012; Massoud et al., 2009; Parkinson & Tayler, 2003; Suriyachan et al., 2012). This PhD research endorses the importance of this fundamental characteristic of decentralized wastewater management, but does not want to reduce decentralized systems to purely technocratic solutions that merely seek a more cost-effective means of service delivery. It addresses the notion of decentralized management in a manner of *searching multi-scalar development approaches to the interconnected household and city-wide sanitation problems,* as well as of *finding possible governance platforms for water and sanitation service co-provision that allow communities to play an active role in development*.

The decentralization approach to wastewater management must be situated alongside the goal of a sustained and meaningful local development initiative. Pursuing sustainable local development requires both institutional innovation and innovative social-economic activities; this will enable a decentralized wastewater management system to generate both inter-scalar and inter-sector synergies, benefitting local communities and simultaneously the city as a whole (Paper 4). Wastewater issues flow across different development sectors, touching upon issues of social cohesion, (in)justice and (un)sustainability in development processes, (un) even opportunities to access 'formal' basic service provisions, and not least the different levels of community vulnerability and resilience to the rapidly deteriorating urban environment. Hence, improvements in other sectors of economy and society may grow from the many local interventions of sanitation improvement programs.

Informed by the empirical findings of my research, in what follows, I enhance my previous arguments that new local water management loops can be created by enlacing different reciprocal relations of different community groups. As I argued in Paper 4, these local loops of bio-hydrological balance form the basis for new co-production cycles of better water and sanitation service provision, as well as a healthy city and viable macro-scale watershed ecosystems.

2.1. Disentangling and Enlacing the Metabolic Components of the City

There is no single way to implement the concept of decentralized wastewater management. This is due to the presence of diverse institutional arrangements and the availability of many different technological options for treating wastewater. The technical scope of wastewater management includes single-building on-site treatment systems, cluster or communal models, and larger service areas with satellite treatment and semi-centralized wastewater treatment plants. Worldwide, there are varying categorization systems for decentralized wastewater treatment facilities; they may be categorized according to the number of people served, the number of wastewater treatment plants functioning in a defined area, the volume and characteristics of wastewater treated, or a combination of these three categories (see Libralato et al., 2012). Centralized and decentralized wastewater management systems both have positive and negative implications; hence, their implementation models should always be studied in parallel. It is necessary to consider the co-existence of both approaches when managing the environmental sanitation of a city (Ibid., 2012).

Figure 2 below shows my qualitative interpretation of Jakarta's existing domestic water sector (compare with Figure 1 in Chapter A, the general introduction). Based on the main actors and the (most extreme) nature of water-wastewater management cycles within their operational zones, the current situation can be *simplified* according to four types of management system. They are:

1.Centralized systems of piped-water and sewerage, managed by the provincial-state water and wastewater companies

In Jakarta, the two state utilities of water supply and sewerage systems have been managed by different bodies, making it difficult to generate the synergies necessary for what has been called a 'closed water loop for community hydrological balance'. Finding potential technical solutions for local hydrological balance within the state system apparently necessitates bureaucracy reforms to address administrative complexities within the provincial government of Jakarta, promote a less market-oriented policy framework for the industrialization of clean water provision, and at the same time, enable cooperation and synergies between the two infrastructure utilities (see Paper 3).

The piped-water networks cover some 60 per cent of the Jakarta administrative area, but not all people living within this area are connected to the service. However, those connected do not always receive good quality and sufficient water. Wastewater management coverage is very low, leading to scarce water sources for the water supply production, and thus intermittent supplies. The existing state sewerage system serves only two per cent of Jakarta's area. It is able to treat the collected wastewater, but only insofar as to make it environmentally safe according to the central government's definition: safe effluent from wastewater treatment plants has a BOD of 100mg/l, SS at 100 mg/l, 10mg/l of oil and grease and a pH of between 6 and 9. The state water system does not extend to recycling and reusing wastewater.

2.Private provision systems in gated industrial clusters, commercial buildings and luxurious apartments in central business districts

In addition to obtaining water from the state piped-water networks or privatized artesian wells, many private sector players have begun to recycle and reuse a large volume of their wastewater. In the absence of satisfactory state-led service provision, many property developers have adopted this strategy to meet their needs for clean water for their daily operating activities. Of the four system types identified here, this water-wastewater system is the least influenced by community informal practices.

3.Private provision systems in middle-class housing estates

Some housing complexes are equipped with decentralized piped-water systems, but no local sewerage systems. Many houses in housing estates use watertight septic tanks for safe disposal of black water. However, many septic tanks still leak, causing a large volume of grey water polluting the environment. In general, housing estates in Jakarta do not recycle or reuse wastewater.

Like the second type outlined above, to a certain extent, the decentralized procedures apparent within this system have been applied without strict legal frameworks, administrative regulations or guidance from the state. The private sector could actually gain certain benefits from the co-existence of different local balanced hydrological systems, such as decreased competition over scarce water resources at the city-wide level and reduced risk of hampered business activities. Regulatory biases have meant that the water-wastewater cycle within the private systems is not optimal, while water-

use rights of less-privileged communities, who deploy simpler technological systems, are not protected (see Paper 1 and 3).

4.Highly informalized provision systems in kampungs

The quality and quantity of community self-provision in water management keep decreasing, while the population in kampungs is growing. Many households directly dispose untreated wastewater into the ground or nearby water bodies, harming the viability of traditional wells.

Several community-based initiatives, developed in cooperation with local (district) authorities and/or NGOs, have aimed to improve current environmental sanitation services in kampungs. However, their impact is too small and their number is far from sufficient to meet overall needs. Moreover, their sustainability remains an open question. In short, kampung residents have become highly dependent on the state and both formal and informal markets for continuous and sufficient clean water supply.

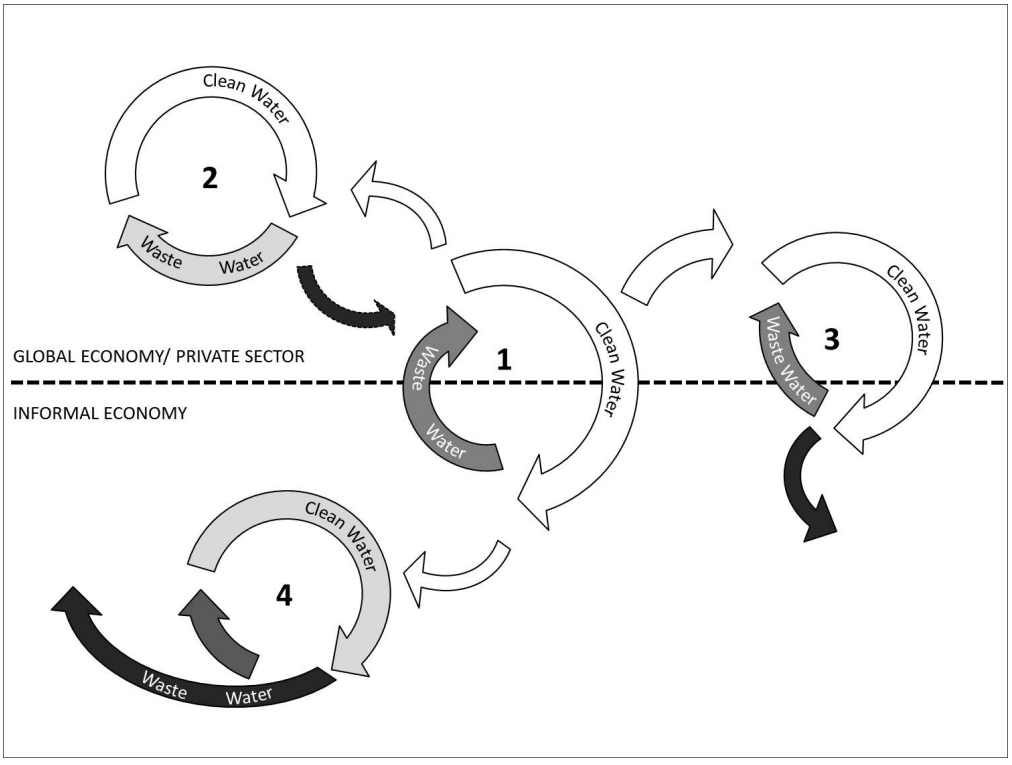

Figure 2.
Existing water management in Jakarta: a simplified situation
Source: the author

1. State-led centralized piped-water and sewerage systems
2. Private provision in gated industrial clusters, commercial buildings and luxurious apartments
3. Private provision in middle-class housing estates
4. Highly informalized provision in kampungs

With the figure above, I would like to highlight the needs of the multiple governance systems associated with water supply management. It further helps to imagine how synergies can be achieved between micro-scale green development and macro-scale watershed management involving interconnected semi-autonomous water management clusters. For integrated water management and sustainable water consumption to be applied at the city-wide level, these four types of management system need to improve their performance so as to become locally self-sufficient in providing water and sanitation for certain population groups. However, as discussed in Paper 3 and 4, we need to be aware that 'being locally self-sufficient' is hard to achieve, especially in Jakarta's urban kampungs, and also involves endless conflicts about water-use rights. Such conflicts are embedded in territorial dynamics and their inter-connected socio-economic settings.

Water and sanitation services are institutionalized in different ways in different settlements, due to unique and specific collective spatial practices (Paper 1). On the one hand, this is integral to the metabolic processes associated with the reproduction of uneven development, but on the other hand such diversity provides many different opportunities. It has been argued that different social relations of exchange, involving a complex web of institutions and actors as well as many forms of the material H_2O, are the basis for alternative water management strategies that rely on community-based control and organizing systems (Paper 1 and 4). Adhering to this principle, the four-type water management model can be developed into several platforms of partnership. In its current practice, this model includes diverse arrays of public and private agencies and community organizations; these have all been formally and informally engaged in providing water and sanitation services, although their activity is not yet sustainable. Hence, none of these four types should be imagined as a single system within a certain spatial enclave. Multiple closed hydrological loops must perform at the same time, and that conjunctures between these loops, either in the form of frictions or higher levels of cooperation, should be managed by the state authorities.

The cases of Orangi and Kampung Kojan have given more insight into our search of socially-innovative coproduction models for better water management systems. I have discussed the relevance of the Kampung Kojan and Orangi case studies because of their potential for social innovation and co-production (Paper 3 and 4). These two projects –one delivered by Mercy Corps in Kampung Kojan in Jakarta, and the other initiated in Karachi as part of the Orangi Pilot Project– were situated within very different developmental contexts, with different geographical and demographic specificities, and different scales of intervention. From its inception, the OPP considered the whole of Orangi Town as its intervention area, the size of which corresponds to two districts of Jakarta.

Nevertheless, there are practical and theoretical conclusions that can be drawn from Kampung Kojan and Orangi when taken together. It is primarily because of their different intervention scales that I consider these two models can be developed together into two different systems of semi-autonomous water management cycle in one city. I propose that these two systems should function in co-existence, to become meaningful at multiple territorial scales; by this I mean that together they are able to improve the quality of wider urban environments, while each one provides an optimum response at its specific 'local' level.

Below, I would like to stress their differences regarding two aspects of community practice, as regards appropriating land for building their settlements, and appropriating certain water infrastructure technologies to solve household sanitation problems. I argue that we need to take these two aspects into account when designing strategic wastewater management projects with a view to generating further socially innovative co-production.

The katchi abadis in Orangi Town grew up on state-owned land, and the site was divided by local community-based developers, or 'illegal' developers according to the vocabulary used by the government. Strong networks of local builders and construction material providers were also involved (Hasan et al., 1999). One result of this is a rather regular physical pattern of road-alley arrangements. Homes are located along straight lanes, making it easy for households to apply a local drainage-cum-sewer system that, in many cases, was linked to the closest water bodies, the nallas. Karachi's moderate arid climate and low average precipitation level makes it ill-suited for a water-borne sewer system. Luckily, Orangi is located on higher ground, so the nallas flow easily towards the sea. However, downstream katchi abadis risk a flow of untreated faecal waste and other types of domestic wastewater. Furthermore, when the monsoon comes, the city becomes vulnerable to floods and, again, communities in downstream katchi abadis suffer more than those upstream. **Figure 3** shows the location of Site Town, at the southern end of Orangi, on the downstream area of Orangi Nalla, one of Karachi's main rivers. During one monsoon, this township suffered from overflowing nallas that had been covered due to people's aversion to human waste (**Figure 4**).

At the time the OPP was launched and then implemented, it seems that the vision of decentralized wastewater management and its potential benefits had not been re-discovered in Karachi. Many ecological sanitation systems, which basically seek to treat wastewater at the household level, right after it is produced, are suitable for areas with a dry climate (see Tilley et al., 2008). However, within the communities, there was apparently no tradition of hygienic handling and treatment of excreta at the neighbourhood level. This fact, in combination with high living density, led to the pragmatic approach to removing human waste as rapidly as possible by depositing it into the nallas through a local sewer system.

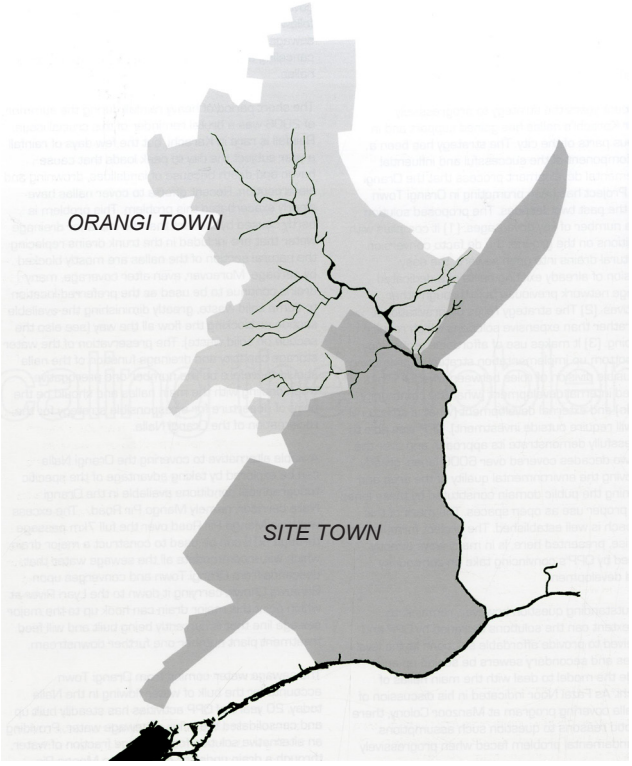

Figure 3. The location of SITE Town relative to Orangi Town
Source: Dehaene & Amerasinghe (2007)

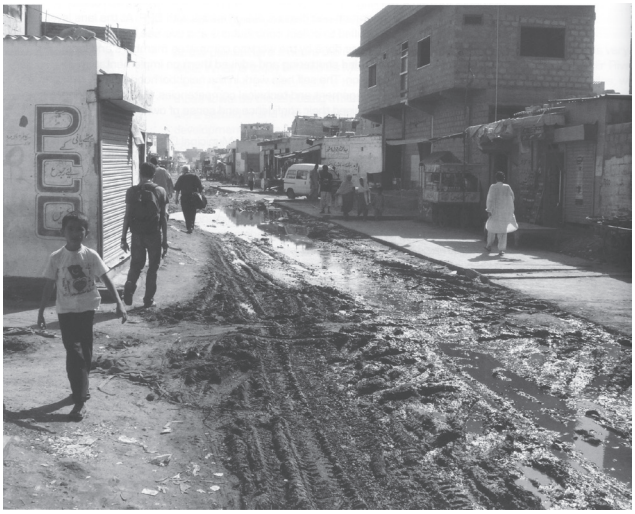

Figure 4. An overflowing covered-nalla in SITE Town
Source: Dehaene & Amerasinghe (2007)

Communities in Kampung Kojan also habitually use water bodies to dispose of wastewater. As the kampung is low-lying, and because of the wet tropical climate, it is surrounded by an abundance of filthy water. Although the ducts and canals passing the kampung are small, they are always full of water. Given the quantity of water available to dilute the waste, water bodies are rarely covered to avoid contact with faecal waste, although some encroachment over water bodies has occurred, mostly for creating passages or terraces (see **Figure 5**).

Although the high water table means there is enough water for flushing, it would be difficult to have a conventional sewer system in Kampung Kojan, as Mercy Corps pointed out in its study (Paper 3). Moreover, given its incremental physical development, the morphological pattern of the kampung is not suited to a conventional sewer system. Kampung Kojan, like other kampungs in Jakarta, is characterized by irregular road patterns and small alleys resulting from various forms of informal land occupation, most of which occurred on an individual basis. All of these elements were used to justify the strategic decision to improve on-site wastewater management at the neighbourhood level (Paper 3). There is, however, an interesting spatial feature to work on when developing a communal wastewater management system. Kampungs like Kampung Kojan and Kampung Muara Baru comprise many rental rooms built on individual land parcels. Potentially, these may become micro-clusters within a communal wastewater treatment system that would integrate with future public open spaces. I have discussed how the current sanitary condition of Kampung Kojan could be improved, notably by collecting wastewater in a combination of septic tanks and solids-free sewer networks, which could then be connected to state wastewater infrastructure systems or local end-treatment facilities at the sub-district level (Paper 3).

To look closer, with the perspective of socially innovative sustainability, the OPP's co-production approach could have been leverage to create more radical political moments in a sense of what I explain below. The aim of wastewater management and sanitation development should not merely be to force the state to provide the larger components of sewerage systems, which cannot be provided and operated by the financial and human resources available within the communities; from a radical viewpoint, challenging the conventional leadership of urban infrastructure governance also means deconstructing the conventional socio-technological system and the associated production mechanisms. The lane sewers were developed within the logic of a centralized sewerage system, making local communities highly dependent on the state in the long run. This dependency arose mainly because local communities can only control partial segments of a single infrastructure system, the end point of which must be managed by the state; otherwise, the solution would fail to solve the local environmental problems.

Figure 5. Settlement interfaces with water, Kampung Kojan
Source: the author and Setiaji Wibowo, 2011

Communities in Kampung Kojan had to face a similar problem. The cost of maintaining and improving public latrines and sludge collection devices in the kampung, and investing in service expansion and final treatment facilities, must inevitably be covered by 'external' funding from outside the community. On the other hand, continuous need for major external investment could impede the emergence of self-sufficient local hydrological loops. To perform as valid co-producers, communities should demand that the state provide water infrastructures that are easy to replicate, maintain and modify, hence, allowing neighbourhoods to become a sustainable, semi-autonomous spatial entity of environmental and water resource management.

I have argued that attitudes towards wastewater must be changed, and that wastewater must be treated as a renewable resource from which energy, fertilizers and potable and non-potable water can be derived (Paper 3 and 4). From the experience of Jakarta's kampungs, it can be concluded that a community can only recognize this potential if it has knowledge of the nutrients and pollutants contained in its wastewater, as well as of the proper treatment systems that can be applied in order to recycle and reuse wastewater. It is important to note that the communities of Perumahan Malaka Sari and Kampung Kojan only came to understand the importance and potential benefits of managing wastewater for their environmental health, through the wastewater and sanitation projects in their neighbourhoods that were introduced by *outsiders*. But, current common understanding within the communities mainly concerns health protection, in accordance with the view that wastewater is merely a source of harmful elements. As such, it is important to introduce interactive wastewater treatment infrastructures like wetlands and lagoons, as these also function as public space that can mediate community discovery processes and promote understanding of wastewater within productive metabolic cycles (Paper 4).

It is even better if treatment of the different wastewater components begins where it is produced, notably by incorporating user-interface technologies that allow flow separation at the source, such as dry toilets and waterless toilets with urine diversion to optimize generation of biogas and fertilizer (see Libralato et al., 2012; Tilley et al., 2008). The wastewater-flow separation approach enables many metabolic processes to be disentangled, but at the same time, the disentanglement processes allow different community activities to be interwoven to ensure effective service provision across different development sectors involving water, energy and agriculture. As such, closing the hydrological cycle at the local level also means pursuing integrated land-water management.

Despite their current limitations in developing semi-autonomous local water loops, the cases of Kampung Kojan and Orangi show that initiating bottom-up wastewater management

processes has made people talk about who disposes of what, and how. This constitutes a starting point on which to build discussions about what else can be done with wastewater, who can benefit from it, and how its use should be governed in the long run.

2.2. Co-producing New Nature through a New Environmental Citizenship

It can be concluded that decentralizing wastewater management does not mean leaving the problems of wastewater management to the sole responsibility of local communities. Neither should decentralized wastewater management be understood as simply dividing an urban area into different local systems, because this would be no different from dividing the market of centralized water and wastewater systems into several service areas while retaining one local monopoly operator for each operating territory. If decentralized wastewater management systems are to become a viable alternative model for increasing the water and sanitation services available to the poor, they require active community participation as users, providers and regulators.

After disentangling the material circulation of wastewater components, we have come to fully understand that people, social groups and communities do not consume water infrastructure services in the same way, for a variety of reasons, including personal preferences that involve norms and traditions, collective practices for cohabitation, and the availability of technological devices. Day-to-day processes for appropriating wastewater management technology vary in both quality and quantity. Moreover, different households rate their water and sanitation needs at different levels of priority.

This PhD research has been an attempt to answer the question of how to organize these individual household activities to achieve the collective goal of more sustainable water resource management. It has specifically addressed the socio-ecological problems of kampung communities characterized by different income structures, irregular patterns of working hours, constantly changing compositions of cohabitation, and so on. Indeed, disentangling the material circulation of wastewater in this kind of neighbourhood is central to solving the problems of specific social relations in development. Apart from securing commitment from within community groups, the journey towards socially innovative coproduction for integrated water management also appears to require commitment from many other development actors, including NGO managers, student organizations, academic scholars, and officials from local government agencies. These actors have engaged with communities through varying development programs and project interventions; and although the time span was usually limited, there have been valuable exchanges of knowledge and experience. While specific

forms of technical and engineering knowledge about more sustainable water management have been cultivated by planners, designers, water engineers and other urban professionals, what matters is the valorisation of such knowledge to become community actions. Community know-how, including members' tacit knowledge, plays a key role in this. Very often, such knowledge is excluded from the formal planning arena.

Certainly, deprived communities need 'enablers' in achieving development progress. These 'agents of change' very often come from educated and from better-off societies (see also Loftus, 2009a; Loftus & Ekers, 2008). Enablers may be outsiders, but it is the grass-roots organizations and local NGOs that sustain inter-sector development synergies through their day-to-day urban governance practices and the institutional capital that enables them (Paper 4). By institutional capital, I mean the collective mechanisms, behavioural norms and habits that sustain many types of short-term initiative and enable them to become integrated actions while securing the longer-term commitments of various actors. This includes the on-going efforts to identify appropriate sanitation development models that meet the needs of a continuously changing urban environment.

Up to this point, 'new environmental citizenship' can be defined as a collective status of community groups, rather than an individual one based on a concept of 'universal rights' (following Chatterjee, 2004). Attached to this collective spirit is new ecological consciousness that drives new relationships of socio-ecological harmony, as has been similarly argued by Loftus (2009a). The concept of modern citizenship, based on individual rights and duties within the context of the welfare state, is often situated in opposition to the status of 'consumers' within a neoliberal context where many basic infrastructure services have been commercialized (Bakker, 2007). The concept of new environmental citizenship takes distance from this opposition and should be situated at the intersection between plural governance systems that are built on the foundations of a commonly agreed 'right-obligation' rationale (following Allen et al., 2006; Hofmann, 2011; Ostrom, 2010; Parra, 2013). At the heart of this new collective status is the welfare spirit that underscores a bottom-linked, transformative and participatory governance system, epitomized by grassroots aspirations, empowered reciprocities and continuous solidarities (see Hickey & Mohan, 2005; Mingione, 2002; Moulaert et al., 2010). The new environmental citizenship embodies many positive aspects of modernism, such as scientific progress and the emancipation from unjust, feudalistic social relations, in which the ecological balance of ecosystems is deemed integral to pursuing social justice (following Cook & Swyngedouw, 2012; Hickey & Mohan, 2005; Mingione, 2002).

3. PLANNING FOR AND WITH DIFFERENT TEMPORALITIES

For over a century after their inception, spatial planning practices in Jakarta were based on land use zoning, but this has proved an ineffective approach for guiding spatial development processes given the complex environmental and social problems of this coastal city (see Silver, 2008; Steinberg, 2007). This PhD research was based upon the insight that strategic spatial planning could play a coordinative role among fragmented sectoral planning processes in Jakarta, with water management as the keystone of spatial structuring processes. It has discussed formal planning processes in the wastewater sector and analysed them in relation to on-going territorial dynamics driven by many forms of informality. I have shown that there is a need to generate synergies between state-led and community-led planning systems, and leverage their co-existence as an opportunity to accommodate varying community needs within diverse territorial dynamics in Jakarta.

'Integration' has been one of the key words in this dissertation. It implies the need for coordination among and coherence in several development sectors and different spatial and temporal scales, in order to accommodate varying interests and initiatives from different actors. Conventional planning traditions and rigid government institutions have caused various processes to impede progress towards integration in planning, and thus helped hinder the improvement of deprived neighbourhoods and the city's overall environmental condition through sustainable local development processes. It has been argued that there is a need to steer spatial planning processes and orient them towards a better water management system in metropolitan Jakarta and beyond (Paper 4). To avoid continuing the tradition of technocratic planning, integration between water management and spatial planning must become a strategic concern that mobilizes collective actions within a community and causes it to keep searching for a socially- and environmentally-improved living habitat.

3.1. Becoming Resilient to an Open Future

The combination of global environmental change and rapid population growth with mushrooming poor settlements in the Global South has raised unprecedented challenges for planners and urban managers (Blanco et al., 2009). Jakarta is a perfect example of a coastal metropolis with a fast-growing population, which must face the risks associated with rising sea levels and annual flooding. Unfortunately, as shown in this dissertation, the development of Jakarta's wastewater sector has regressed instead of progressing. No progress has been made in

tailoring environmental sanitation management to the specific biophysical characteristics of an urban agglomeration in a coastal area, account taken of the various intertwining historical trajectories of socio-political and economic systems (Paper 2 and 3).

The challenge for Jakarta is not merely to produce an engineering master plan, but to develop an approach that integrates the roles of all relevant agents from all relevant sectors at the appropriate territorial level. Technical instruments to collect and treat the waste cannot solve the problems by themselves; an integrated approach is needed, involving communities, planning agencies and engineering offices. The main objective of wastewater management should be to organize the various *actors* who already provide, or are eager to provide, any kind of technological system that is considered appropriate for dealing with wastewater and other water-related problems in their neighbourhoods.

Wastewater management should form the core of Jakarta's water management, because it requires the involvement of all tiers of governance. Its activities serve households, neighbourhoods and the city; its domain extends from family toilets and neighbourhood treatment systems to large-scale sewer networks, city treatment-plants and sludge collection points. In this sector, planning should start by asking the following question: *What do communities want to do with their wastewater?* While it has been argued that wastewater should be recycled and reused, there are many ways in which this can be done. Defining the technical purpose of treating wastewater, and selecting the most appropriate system from the several possible organizational and technological options, should be done at each level of governance: neighbourhood, district, municipality, etc. Most importantly, it is necessary to define the concerns for which *actors* will have managerial and operational responsibility, and at which levels these *agents* will play their roles.

The benefits of applying small-scale decentralized systems have been discussed in this dissertation. It has also been argued that the issue of wastewater management should be included in the spatial planning domain, mainly because the organization of wastewater infrastructures in combination with other (water) infrastructures cannot be separated from the organization of land. Restoring the hydrological balance, closing the water cycle in a sustainable way is one pragmatic step towards building a common conception of spatial quality (Paper 4). Critical analysis of the case studies has shown that the improvement of the wastewater management system in Jakarta should begin at the neighbourhood level, in groupings of housing estates, kampungs, commercial districts or mixed land-use clusters. However, due to the fast-changing urban environment, delineation of local wastewater management governance units, coupled with the application of certain water infrastructure technology, must be seen as an open decision-making process. In this way, their appropriateness can be reviewed within a relatively short time period.

On a Jakarta-wide scale, it is important that planning regulations require developers to include proper wastewater treatment facilities in the settlements they develop. My empirical findings have shown that it is relatively simpler to manage wastewater in real estate developments than in the more heterogeneous kampungs. In addition to the great variety of spatial features that reflect the complex spatial condition of the kampungs – e.g., elevation, inclination, density, morphology, and typology – and geomorphological factors – the height of water table, type of soils, etc. – planners also have to deal with different temporalities. This temporal complexity is embodied by rapidly changing kampung populations as well as the life-cycles of infrastructure projects and their investment programs. The experience of the NGO Mercy Corps and the community in Kampung Kojan are concrete examples of these time-based dynamics: the NGO had to work within the time-frame set by the donors; rental room owners need to share the infrastructure maintenance costs with their tenants, who mostly work on casual jobs or short-term work contracts; and septic-tanks have to be desludged approximately every one or two years, while there is a need to organize the desludging works collectively to create an effective link with the municipal wastewater management system.

Clearly, spatial planning is a field of negotiation that should not be dominated by corporate ambitions to provide technocratic prescriptions; political power will be needed to overturn the imbalance of water management, taking into account the needs and governing capacities of the kampungs. Negotiations between the municipality and kampung-neighbourhoods along Jakarta's thirteen rivers are also essential to improving the socio-ecological relationships imposed by the river system. Such negotiations could serve as a spine for the city-wide governance of water and sanitation planning system. I will come back into this issue in the next sub-section, 3.3. Looking back at historical planning trajectories in Indonesia, it seems that many efforts are needed to break the path-dependency of technocratic planning. The early-modern colonial state has built Jakarta by giving a central role to water engineers; and the modern spatial planning processes introduced in the early twentieth century have given prominence to architects and civil engineers (Paper 2). This caused the complexity of the patch-worked urban fabric to be overlooked. This historical mistake can only be corrected through an integrated multi-scalar planning and governance system in which the diversity of human needs is taken into account.

3.2. Mind the Gap! From (Spatial Planning) Policies to Strategic Projects

Reform within national policy-making processes has led to the adoption of community-based sanitation development alongside the conventional development strategy (see the general

introduction and Paper 3). The recent national strategy requires municipalities to map the diverse sanitation conditions across the city and to inventory the existing sanitation and wastewater infrastructures delivered either by the government, communities or private sector players. This is expected to provide the city with a city-wide sanitation development strategy and associated investment plan that take account of the existing situation.

My field work in Jakarta has found that, although there have been ideas for change at the national level, mainly steered by the National Development Planning Agency, the governmental bodies at the Jakarta level still stress the top-down approach of centralized wastewater management and the application of large-scale sewerage systems. I have highlighted some of the institutional gaps that make it difficult for Jakarta to apply a community-based approach to sanitation development (Paper 3). A diverse range of technological wastewater infrastructure models is available, and many of these models could feasibly be applied in Jakarta, but there has not been enough room to study their potential for large-scale application. In saying this, I do not intend to promote a modular decentralized wastewater treatment system within the context of a one-size-fits-all technological system. Section 2 of this general conclusion has elaborated the socially-innovative approach to decentralized wastewater management. Account taken of the constantly changing urban environment, the challenge faced by the government of Jakarta does not solely consist in overcoming gaps in adopting and implementing the national community-based sanitation development policy. There will always be gaps between plan-making, political decision-making and implementation of a plan in terms of programs and projects (Albrechts, 2006). What I would like to highlight is whether or not the government of Jakarta has the institutional capital needed to keep bridging the gaps between any previously-established policies and on-going changes in the aspirational agendas of local communities.

In principle, strategic spatial planning offers planners and other actors the opportunity to work on a consensus basis so that, if necessary, stakeholders can keep altering the direction of implementation strategies while maintaining progress within the previously agreed development platforms (compare with Albrechts, 2006, 2012). This PhD research has sought to identify ways in which water works may constitute strategic projects that play an important role in both regenerating and transforming urban areas, and in bettering the essential social relationships that drive on-going local development processes (Paper 4). It has argued in favour of ecological and hydrological ‘soft’ wastewater infrastructures that allow for a flexible infrastructure life-span and the application of lower-cost, environmental-friendly technologies.

Further research is needed to understand how strategic spatial planning with a view to achieving integrated water management can help to change the nature of land-use zoning,

which is currently defined in top-down manner. I have argued in favour of water management systems that are integrated at sub-district or district levels. Within this model, bottom-up aspirations are the key for driving integration, and perhaps land-use allocations can be defined at this scale. Community-based governance of environmental sanitation provision systems works well by making use of technologies that are tailored to local needs. Integrating the collective management of local hydrological systems into a broader community development programme can be made yet more effective by attributing a central place to public space as a socio-infrastructural whole, as some realizations of the Kampung Improvement Program in Jakarta have shown.

3.3. Urban Kampungs and the Future of the City

Kampungs are spatially dispersed and each one occupies a relatively small area. This morphological pattern, as well as the modes of individual land ownership within kampungs, has made kampung communities vulnerable because, beyond the risk of immediate eviction, other urban functions can slowly encroach upon kampung areas (see **Figure 6**). The current spatial development master plan (Jakarta 2030) involves replacing the kampungs of Kalideres sub-district with industrial functions. It is ironic that, during my fieldwork in 2011, I never heard these plans discussed among residents. It seems that they simply were not informed about the development plan. Past experience has shown that kampung communities are often evicted by mega development projects (Paper 2). However, the state has never been able to provide enough units for the relocated families in formal housing blocks (see in Paper 4 for the recent case of Waduk Pluit), erroneously assuming that these people had agreed to drastically change their cohabitation lifestyle.

When water engineers talk about hydrological balance i.e. the cycle of clean water production and consumption, it is important to ask whose hydrological balance they are actually talking about, given that varying and overlapping local territorial processes involve different actors. I have argued for a micro-scale green development concept with multifunctional wastewater infrastructures. Apart from helping preserve the hydrological balance at the greater scale, such infrastructures also help maintain the closed productive-reproductive cycles of community livelihoods.

Considering Jakarta's kampungs, I conclude that a good wastewater management system should be designed in a way that enables the involvement of different reciprocal social relations to support local integrated water management. It has been argued that the role of state agencies must be adjusted to the needs of different territorial dynamics, and that this must be done alongside processes that strengthen the power of reciprocities. Reciprocal relations are the

Figure 6.
A kampung in Duri Kosambi, West Jakarta, surrounded by high-rise apartments and polluted canals
Source:
courtesy of Frank Moulaert, pictures taken in 2011 during our field work with Mercy Corps and local government officials

key element of informality; beyond their role as a survival strategy, they constitute a form of institutional capital that connects different traditions in environmental management. It seems that the scale of a decentralized wastewater management system should be coherent with the scope of reciprocal dynamics. This ensures that the infrastructure models to be applied are chosen based on consensus between different types of users at a particular scale, instead of imposed by providers and/or regulators.

I have portrayed urban kampungs in Jakarta as grey settlements for being neither fully integrated within formal development processes nor completely eliminated from the urban landscape, as well as for having poor sanitary conditions and surrounded by or suffered from untreated grey water (see the general introduction and Paper 2). Findings of this research have suggested that turning kampungs from grey to green has many valuable meanings beyond solving the technical environmental problems experienced by local communities and the city as a whole. There would also be cultural and political implications for kampungs as distinct spatial enclaves. I argue that one way to find a new collectivity among kampung communities, and thus a new citizenship, is through seeing the river-side kampungs as connected entities, linked by the rivers and canals (see also Parikh & Parikh, 2009).

Given that many kampungs have been spreading along the river banks, it can be argued that this form of socio-ecological relationship can be enhanced. Enhancing their green status and helping nurture the rivers may enable kampung communities to gain a more visible political status within the urban community. Their internal diversity, combined with their distinct bio-morphological characteristics when compared with other urban clusters i.e. industrial clusters and commercial districts, mean that the kampungs and rivers together can help stitch heterogeneous patches of habitat in the city and thus help protect biodiversity.

I personally believe that kampungs in the city have to be protected and improved. With their varying degrees of socio-ecological permeability (from those that are capable of mediating multiple forms of institutionalization processes, to those that keep practicing traditional-cum-environmentally-friendly environmental sanitation practices), urban kampung communities are resilient to an open future. Their incremental approach to spatial development practices is less destructive compared to the massive market-led development interventions and, in fact, allow different opportunities to keep orientating development priorities, methods of decision making, as well as ways to meet the needs. If kampung communities are seen as active agents for environmental improvement in the city, they must be included in planning processes. This PhD research has demonstrated that urban kampungs can be the site of emancipatory actions through initiatives that promote environmental protection. Together, relationships between the kampung, city and river mediate processes that cultivate a new urban culture and a new environmental citizenship.

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APPENDIX 1

LARGE-SCALE WASTEWATER TREATMENT SYSTEMS IN INDONESIA

City (Administrative Area) (population)	*Sewer System and Treatment Plant*					*The coverage of piped water supply*
	Development in the Colonial Period		*Later Development*		*Current Situation*	
	Year	*Treatment Plant*	*Year*	*Treatment Plant(s)*	*Factual Coverage*	
1. **Bandung** 16,730 hectares/ 4 million population	1916	Imhoff Tank-now is not operating well and overloaded	1980-91	Oxidation and stabilization ponds.	17% of the territory 20% of the population (built for 65% of the population)	52% of population
2. **Banjarmasin** 7,200 hectares/ 600,000 population	n/a	n/a	*1990s*	*No data*	3% of the territory 6% of the population	64% of population
3. **Balikpapan** 5,033 hectares/ 500,000 population	n/a	n/a	*No data*	*No data*	1% of the population	*No data*
4. **Batam** 71,500 hectares/ 1,155,000 populations	n/a	n/a	*No data*	Oxidation-pond system	0.1% of population	*No data*
5. **Cirebon** 3,942 hectares/ 600,000 population	1920	Operating well for 50% of the sewer coverage	1978 1996	Oxidation-pond system	10% of the territory 32% of the population	96% of population
6. **Denpasar** 12,400 hectares/ 575,000 population	n/a	n/a	*No data*	Aerated Lagoon	*No data*	*No data*
7. **Medan** 26,510 hectares/ 2 million population	n/a	n/a	1984-89 1989-95	Aeration and facultative ponds	2% of the territory 2.25% of the population	61% of population
8. **Jakarta** 6.6 million hectares/ 10 million population	n/a	n/a	1982-87 1988-90 1991-96	Aerated ponds.	2.8% of the population	30% of population
9. **Parapat** 5,524 population	n/a	n/a		Aerated Lagoon	18% of the population	*No data*
10. **Surakarta** 4,400 hectares/ 540,000 population	1940	No treatment	1984 1996 (rehabilitation-expansion of the 1940's)	Aerated ponds. No treatment for the 1996 system	26% of the territory 6.2% of the population (built for 13% of the population	51% of population
11. **Tangerang** 18,400 hectares/ 1.5 million population	n/a	n/a	1978-79 1981-82 1991-92	Oxidation ponds	1.5 % of the population	48 % of population
12. **Yogyakarta, greater area** 20,304 hectares/ 1.3 million population	1936-38	No treatment	Before 1992 1994-96	Aerated ponds	6 % of the territory 10 % of the population	35 % of population

Source: Author's composition based on the information from an interview (WSP-EAP personnel in Jakarta, 2009); USAID (2006); ADB (2007); Kearton et al. (2013)

APPENDIX 2

UTILISATION OF WASTEWATER TREATMENT PLANTS IN 12 INDONESIAN CITIES

No	*City*	*Capacity Plant Used (%)*	*Capacity Sewer Used (%)*
1.	Bandung	51	34
2.	Banjarmasin	96	96
3.	Balikpapan	64	38
4.	Batam*	5.3	*No Data*
5.	Cirebon (WT1,2,3,4)	15, 90, 60, 60	16, 65, 43, 59
6.	Denpasar	61	*No Data*
7.	Medan (WT1&2)	28 & 8	87, 21
8.	Jakarta	12	30
9.	Parapat*	6	*No Data*
10.	Surakarta	98	47
11.	Tangerang	35	45
12.	Yogyakarta, greater area	63	74

*Source: Author's composition, based on USAID (2006)and *Kearton et al. (2013)*

APPENDIX 3

LIST OF INTERVIEWEES

Code		*Name*	*Position on the date of interview and relevant previous position*	*Date*	*Approximate time of interview (minutes)*
I.		National Development Planning Agency (Badan Perencanaan Pembangunan Nasional - BAPPENAS)			
1	a	Nugroho T. Utomo	Director, Directorate of Housing and Settlement Daily Secretary of Pokja AMPL	05/ 11/ 2010	35
	b	Oswar Mungkasa	Former Head, Division of Drinking Water and Waste Water, Directorate of Housing and Settlement Former Daily Secretary of Pokja AMPL	07/ 04/ 2011	45
II.		Ministry of Public Works (Kementerian Pekerjaan Umum - PU)			
2	a	Hendropranoto Suselo	Former director at Directorate General Human Settlements (Cipta Karya) Conceptual-leader of former IUIDP (Integrated Urban Infrastructure Development Programme)	03/ 11/ 2010	45
	b	Ramalis Sobandi	West Java IUIDP	26/ 07/ 2010	60
	c	Handi B. Legowo	Head, Division of Wastewater, Directorate of Environmental Sanitation Development	11/ 02/ 2011	75
	d	Susmono	Former Director, Directorate of Environmental Sanitation Development	27/ 01/ 2012	90
	e	Pong Sinurat	Project Leader, Special Task Unit for Jakarta Metropolitan Area Water Infrastructure Development	18/ 01/ 2011	30
III.		DKI Jakarta Provincial Government			
3	a	Andi Baso	Former head of a division at Regional Development Planning Agency (Badan Perencanaan Daerah – BAPEDA) Head, Bureau of City Infrastructures and Facilities	04//11/ 2010	50
	b	Vera Revina Sari	Former Head, Division of City Infrastructures Facilities and Environment, Regional Development Planning Agency Head, Bureau of Spatial Planning and Environment	28/ 03/ 2012	45
	c	Budijanto	Leader, Section of Sanitation and Pollution, Bureau of Spatial Planning and Environment	04/ 11/ 2010 28/ 03/ 2012	20
	d	Kusnindar	Leader of a section at Public Housing Agency	27/ 08/ 2010	90
	e	Izhar Chaidir	Head, Division of Urban Spatial Planning, Spatial Planning Agency	14/ 03/ 2012	15
	f	Joni Tagor	Leader, Section of Habitat and Environmental Sanitation Control, Regional Environmental Management Agency (BPLHD)	08/ 11/ 2010	30
	g	Eko Gumelar	Staff at BPLHD	08/ 11/ 2010	45
	h	Bambang S.	Leader, Section of Method Development and Environment Management, Cleansing Agency	27/ 03/ 2012	70
	i	Herning Wahyuningsih	Former Leader, Section of Wastewater, Public Works Agency Leader, Section of Water Resources Planning and Management, Public Works Agency	20/ 01/ 2011	30
	j	Teguh	Operator, Malaka Sari Communal Sewerage and Treatment Plant	25/ 01/ 2011	45

IV.		Municipal Government (West and North Jakarta)			
4	a	Hendri Mardi	Leader of a section at Public Housing Agency, West Jakarta Municipality	09/ 01/ 2012	90
	b	Sardjono	Head, Spatial Planning Agency, West Jakarta Municipality	09/ 01/ 2012	80
	c	Ayu Pangastuti	Technical Assistant, Building Authority Agency, North Jakarta Municipality (Dinas Pengawasan dan Penertiban Bangunan – P2B)	19/ 10/ 2012	45
V.		PAM JAYA, provincial-state-owned water company and the private concessionaire			
5	a	Mauritz Napitupulu	Director, PAM JAYA	24/ 10/ 2011	15
	b	Firdaus Ali	Member, Jakarta Regulatory Body for Drinking Water Provision	03/ 11/ 2010	45
	c	Irma Damayanti	Leader, GPOBA (Global Partnership on Output Based Aid) programme, PALYJA	08/ 11/ 2010	60
	d	Vincent Fournier	Technical Assistant, SUEZ Environment/ PALYJA	08/ 11/ 2010	45
	e	Riris Rasmidan	Technical Assistant, PALYJA	10/ 11/ 2010	45
	f	Philippe Folliasson	President Director, PALYJA – during a forum of '13 years Jakarta Water Consession' held by Amrta Institute in Jakarta	30/ 06/ 2011	15
VI.		PDPAL JAYA, provincial-state-owned wastewater company			
6	a	Hendry Sitohang	Staff, Technical Division, PD PAL Jaya	17/ 01/ 2011 29/ 03/ 2012	90
	b	Yudi Indardo	Former Technical Director, PD PAL JAYA Financial Director, PD PAL JAYA	20/ 01/ 2011	25
VII.		Neighbourhood Agencies			
7	a	Mundiyanto	RT 07 leader, Kali Deres Sub-district	05/ 10/ 2011	45
	b	Murodi	RW 06 leader, Kali Deres Sub-district	22/ 10/ 2011	30
	c	Several residents	Beneficiaries of Mercy Corps [14 non-consecutive days of intensive field works + 7 non-consecutive days for preparations and clarifications]	several interviews	n/a
	d	Name unknown	A community member of Perumahan Malaka Sari, met at the treatment plant	25/ 01/ 2011	45
	e	Sriyono	A community leader in Kampung Tugu Selatan	19/ 05/ 2011	A half-day field visit
VIII-XIII.		NGOs and civil society organisations			
8	a	Yodi Danusastro	Rating Analyst, Green Building Council (GBC) Indonesia	18/ 11/ 2010	15
	b	Prasetyoadi	Core Founder GBC Indonesia Deputy of International Relations, GBC Indonesia	27/ 06/ 2011	40
9	a	Siti Adiningsih Adiwoso	Founder, Asosiasi Toilet Indonesia Chief, Board of Directors GBC Indonesia	18/ 11/ 2010	50
10	a	Hanifa Reza	Advocacy Coordinator, KRUHA (People's Coalition for the Rights to Water)	24/ 06/ 2011 18/ 08/ 2011	75
	b	Hamong Santono	National Co-ordinator, KRUHA	24/ 06/ 2011	30
	c	*Stakeholders meeting*	Held by Amrta Institute for Water Literacy	30/ 06/ 2011	185
11	a	Azas Tigor Nainggolan	Coordinator, FAKTA, Jakarta Citizens Forum	27/ 03/ 2012	90
12	a	Richard Ormond	Director of Programmes, Mercy Corps (MC)	01/ 10/ 2010	20
	b	Suryani Amin	Program Manager (PUSH), MC	01/ 10/ 2010 08/ 04/ 2011 18/ 08/ 2011	60
	c	Romli	Field Project Facilitator (PUSH), MC	06/ 08/ 2011	50
				18/ 08/ 2011	+field visit

	d	Evi Febriani	Field Project Facilitator (RW Siaga Plus+), MC	08/ 04/ 2011	30
				19/ 05/ 2011	+ field visit
	e	Agni Pratama	Programme Manager (OWOF), MC	26/ 01/ 2012	90
				26/ 09/ 2012	
	f	Hendratmo	Program Officer (OWOF), MC	21/ 12/ 2011	60
				01/ 02/ 2012	(group meeting)
	g	Gatot	Field Project Facilitator (OWOF), MC	21/ 12/ 2011	
	h	Dewi Nursanti	Programme Communication Officer (OWOF), MC	21/ 12/ 2011	
				01/ 02/ 2012	
	i	Doddy Suparta	Project Coordinator (INSIST), MC	26/ 09/ 2012	90
13	a	Sofyan Hadie	Chief, Kalideres Cooperative	08/ 11/ 2011	80
	b	Mursani	Secretary, Kalideres Cooperative	08/ 11/ 2011	50
	c	*Community meeting*	Held by the Cooperative	21/ 12/ 2011	180
	d	Muhasan	PELITA, a business unit of the Cooperative providing service of septic-tank desludging	21/ 12/ 2011	15
					+ field visit

APPENDIX 4

ASID Framework (presented in the World Planning School Congress in Perth, 4-8 July 2011)

Analytical Components	*'Provisional definitions' in Moulaert & Jessop (2006)*	*How the analytical components influence each other:*	
		Agency	*Structure*
Agency	Individual or collective human behaviour has ability to make significant difference in the natural and/or social worlds.	Interactions between agents exist only within given structures. From stable relationships, there are interdependent emergent properties that *a)* able to structure the interpersonal interactions in certain conjunctures*; *b)* contain both transformative and constraining power for structural elaboration and/or modification.	Individual agency cannot change any structure because structure is external to any given agents and the two are operating in different time intervals. Some collective agents have privileged conditions to be able to make use of transformative power for structural changes via several institutional reforms.
Structure	A set of natural and social realities in certain time span in a concrete spatial context; thus, a structure are necessarily relative, relational and temporary – but over a longer time period.	Structure and its configuration privileges some agents while hinders the others for sustaining certain actions. In responding such dynamics, agents re-orient their strategies and tactics based on their understanding of certain space-time conjunctures. Scalar dynamics of structure allow agents across places and scales to be connected in certain social relations mediated by certain institutions.	There are relatively autonomous different structures with their own orders, institutional consequences, and reproduction mechanisms. However, relations between them create emergent properties with patterns that are mediated by institutions and reproduced by agencies; these emergent properties allow structural coupling, co-evolution and coherence.
Institutions	Socialized structure in the forms of routines, conventions, rules, sanction-mechanisms, and practices; relatively enduring ensemble of constraints and opportunities in specific context.	Institutions mediate constraining and facilitating aspects of structure to govern more or less specific domain of actions within the given structure. There are contradictions within an agency since several simultaneous mechanisms of different institutions are contested and contestable.	Spatial-temporal dimensions of institutions, and the articulations of institutions through social interaction create structural elaboration or modification that for certain agencies become a given structure.
Discourses	Inter-subjective production of meaning.	Discursive features change identities, subjectivities and propensities of individual engagement in social relations.	Discourse can be material practices through several ways of articulation with or without being institutionalized. With institutionalization, i.e. regularization, informalization and embodiment in typical pattern of belief and conduct, discourse(s) can have a significant structural impact.

Institutions	*Discourses*
Path-shaping power of transformative collective agency (that requires necessary internal and contingent external relations for being) might be able to transform specific path-dependent institution and catalyse structural changes.	Productions, (re)articulation of discourses need certain discursive actions from agencies (individual and/or collective) with or without organizational practices.
Structure embodies in major institutions that direct societal reproduction, including mechanisms (to exploit, conserve, etc.) in relation to the nature. New institutions emerge in responding to prevailing mechanisms that are sustaining only certain privileged individuals or groups (see Swyngedouw, Kaika, & Castro, 2002).	Reproduction of structure incorporates discursive reproduction; structure needs certain discourses involving certain agencies and related institutions to maintain its supporting mechanisms.
(Re)Combination of existing institutions might sustain or challenge related social relations, including internal mechanisms of each institution engaged in the processes. The institutions can be those that are supporting the same structure (not necessarily without contradictions) and/or those from contradictory ones.	(Re)Articulation and the replication process of certain discourses are embedded in certain institutional context, but might be originally produced outside the institutional sphere.
New semiotic practices, imaginaries, identities, and subjectivities for strategic actions, 'new' historical narratives, and alternative development views. Creation of new communication and discursive technologies for new behavioural settings.	Discourses meet in certain field, contested or co-developed, in relation to influential agency or agencies in the field with mediation from certain institutional mechanisms.

Source:
Author's reproduction and elaboration from Moulaert and Jessop (2006), Hodgson (2004), Jessop (2005). This table is inspired by Territory-Place-Scale-Networks (TPSN) model by Jessop, Brenner and Jones (2008).

* Conjuncture can be defined as a meeting of two or more certain scalar and temporal properties of trajectories in different social fields and institutional orders that creates definite opportunities or constrains to sustain certain actions and institutional settings, and furthermore, produce institutional changes (cf. Moulaert & Jessop, 2006).

APPENDIX 5 - Types of Wastewater Products (Eawag-Sandec Sanitation Model)

Products

Products are materials that are also called 'wastes' or 'resources'. Some Products are generated directly by humans (e.g. urine and faeces), others are required in the functioning of Technologies (e.g. flush water to move excreta through sewers) and some are generated as a function or storage or treatment (e.g. faecal sludge).

For the design of a robust sanitation system, it is necessary to define all of the Products that are flowing into (Inputs) and out (Outputs) of each of the sanitation Technologies in the system. The Products referenced within this text are described below.

Urine is the liquid waste produced by the body to rid itself of urea and other waste Products. In this context, the urine Product refers to pure urine that is not mixed with faeces or water. Depending on diet, human urine collected during one year (ca. 500 L) contains 2–4 kg nitrogen. With the exception of some rare cases, urine is sterile when it leaves the body.

Faeces refers to (semi-solid) excrement without urine or water. Each person produces approximately 50 L per year of faecal matter. Of the total nutrients excreted, faeces contain about 10% N, 30% P, 12% K and have 10^7–10^9 faecal coliforms / 100 mL.

Anal cleansing water is water collected after it has been used to cleanse oneself after defecating and/or urinating. It is only the water generated by the user for anal cleansing and does not include dry materials. The volume of water collected during anal cleansing ranges from 0.5 L to 3 L per cleaning.

Stormwater is the general term for the rainfall runoff collected from roofs, roads and other surfaces before flowing towards low-lying land. It is the portion of rainfall that does not infiltrate into the soil.

Greywater is the total volume of water generated from washing food, clothes and dishware as well as from bathing. It may contain traces of excreta and therefore will also contain pathogens and excreta. Greywater accounts for approximately 60% of the wastewater produced in households with flush toilets. It contains few pathogens and its flow of nitrogen is only 10–20% of that in blackwater.

Flushwater is the water that is used to transport excreta from the User Interface to the next technology. Freshwater, rainwater, recycled greywater, or any combination of the three can be used as a Flushwater source.

Organics refers here to biodegradable organic material that could also be called biomass or green organic waste. Although the other Products in this Compendium contain organics, this term refers to undigested plant material. Organics must be added to some technologies in order for them to function properly (e.g. composting chambers). Organic degradable material can include but is not limited to leaves, grass and market waste.

Dry Cleansing Materials may be paper, corncobs, rags, stones and/or other dry materials that are used for anal cleansing (instead of water). Depending on the system, the dry cleansing materials may be collected and disposed of separately. Although extremely important, we have not included a separate Product name for menstral hygiene products like sanitary napkins and tampons. In general (though not always), they should be treated along with the Dry Cleansing Materials that are described here.

Blackwater is the mixture of urine, faeces and flushwater along with anal cleansing water (if anal cleansing is practiced) and/or dry cleansing material (e.g. toilet paper). Blackwater has all of the pathogens of faeces and all of the nutrients of urine, but diluted in flushwater.

Faecal Sludge is the general term for the raw (or partially digested) slurry or solid that results from the storage of blackwater or excreta. The composition of faecal sludge varies significantly depending on the location, the water content, and the storage. For example, ammonium (NH_4-N) can range from 300–3000 mg/L while Helminth eggs can reach up to 60,000 eggs/L. The composition will determine the type of treatment that is possible and the end-use possibilities.

Treated Sludge is the general term for partially digested or fully stabilized faecal sludge. The US Environmental Protection Agency has strict criteria to differentiate between degrees of treatment and consequently, how those different types of sludges can be used. 'Treated Sludge' is used in the System Templates and in the Technology Information Sheets as a general term to indicate that the sludge has undergone some level of treatment, although it should not be assumed that 'treated sludge' is fully treated or that it is automatically safe. It is meant to indicate that the sludge has undergone some degree of treatment and is no longer raw. It is the responsibility of the user to inquire about the composition, quality and therefore safety of the local sludge.

Excreta consists of urine and faeces that is not mixed with any flushing water. Excreta is small in volume, but concentrated in nutrients and pathogens. Depending on the quality of the faeces it is solid, soft or runny.

Brownwater consists of faeces and flushwater (although in actual practice there is always some urine, as only 70–85% of the urine is diverted). Brownwater is generated by urine-diverting flush toilets and therefore, the volume depends on the volume of the flushwater used. The pathogen and nutrient load of faeces is not reduced, only diluted by the flushwater.

Dried faeces are faeces that have been dehydrated at high temperatures (and high pH) until they become a dry, sanitized powder. Very little degradation occurs during dehydration and this means that the dried faeces are still rich in organic material. Faeces will reduce in volume by around 75%. There is a small risk that some organisms can be reactivated in the right environments.

Stored urine is urine that has been hydrolyzed naturally over time, i.e. the urea has been converted by enzymes into carbon dioxide and ammonia. Stored urine has a pH of approximately 9. After 6 months of storage, the risk of pathogen transmission is reduced considerably.

Effluent is the general term for liquid that has undergone some level of treatment and/or separation from solids. It originates at either a Collection and Storage/Treatment or a (Semi-) Centralized Treatment Technology. Depending on the type of treatment, the effluent may be completely sanitized or may require further treatment before it can be used or disposed of.

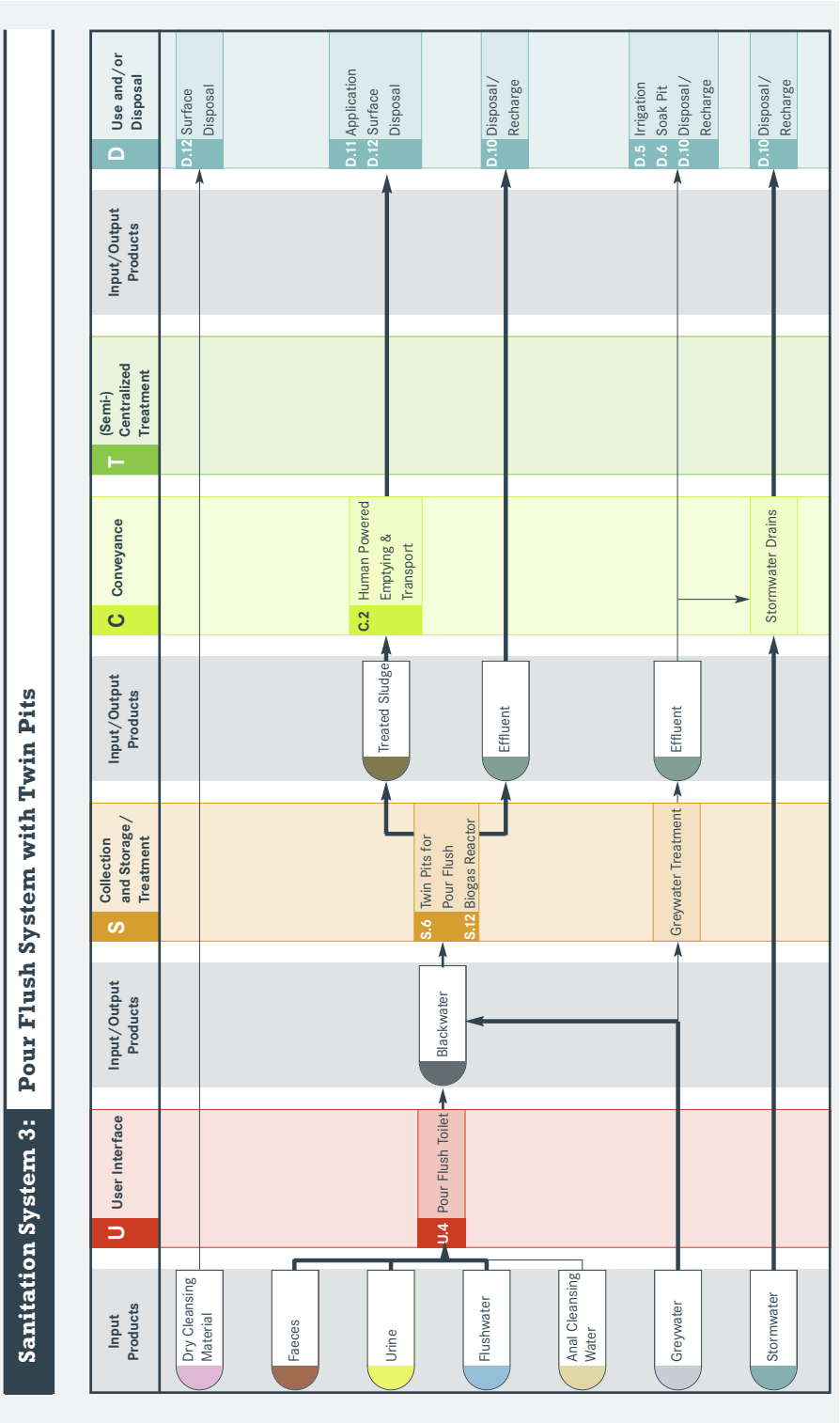
Compost/EcoHumus is the earth-like, brown/black material that is the result of decomposed organic matter. Generally Compost/EcoHumus has been hygienized sufficiently that it can be used safely in agriculture. Because of leaching, some of the nutrients are lost, but the material is still rich in nutrients and organic matter.

Biogas is the common name for the mixture of gases released from anaerobic digestion. Typically biogas is comprised of methane (50–75%), carbon dioxide (25–50%) and varying quantities of nitrogen, hydrogen sulphide, water and other components.

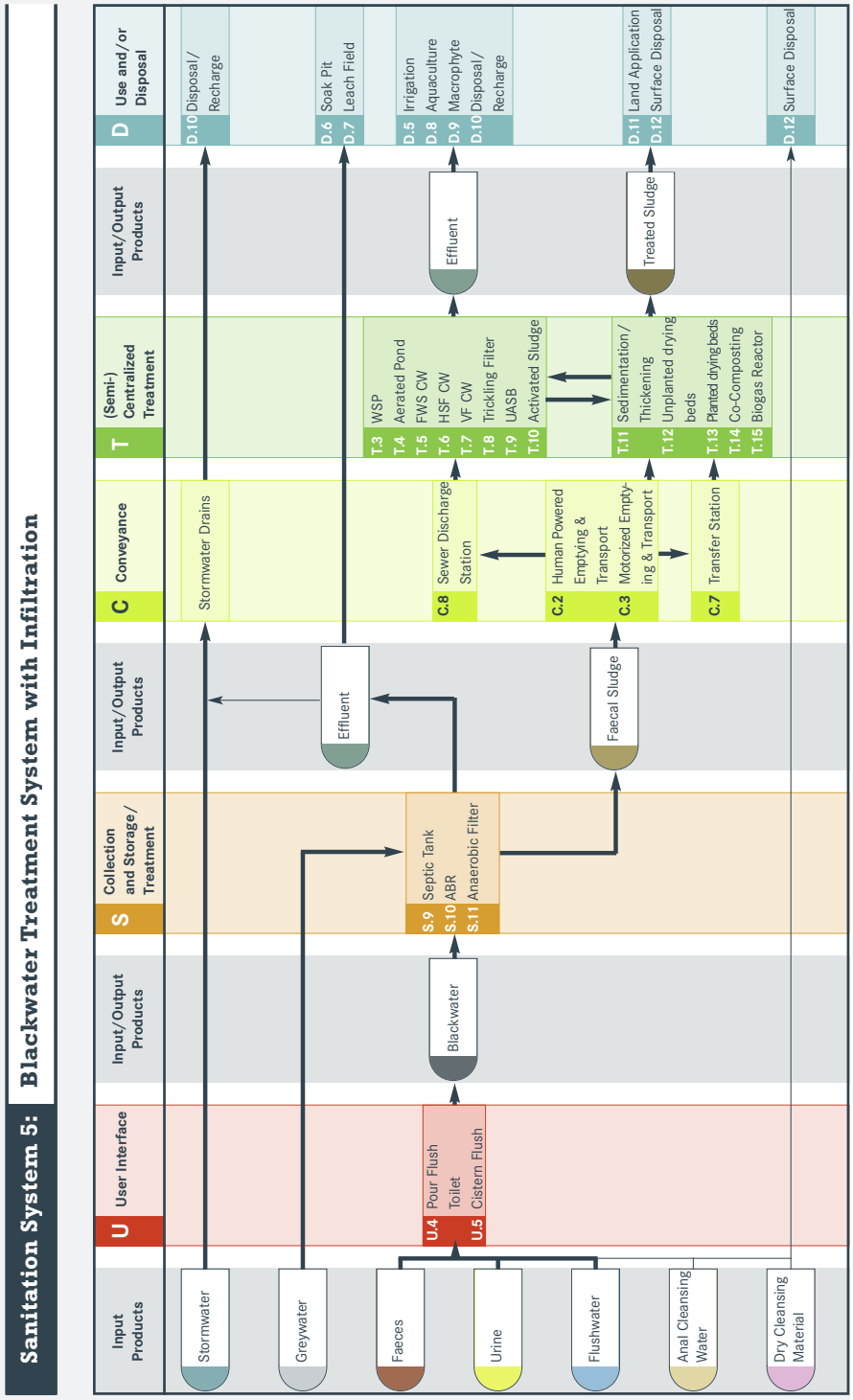
Forage refers to aquatic or other plants that grow in planted drying beds or constructed wetlands and may be harvested for feeding livestock.

Source:
Tilley, E., C. Lüthi, A. Morel, C. Zurbrügg and R. Schertenleib. (2008). *Compendium of Sanitation Systems and Technologies*. Duebendorf, Switzerland: Swiss Federal Institute of Aquatic Science and Technology (Eawag), pp. 11-12

APPENDIX 6 - Two Eawag-Sandec Sanitation Systems

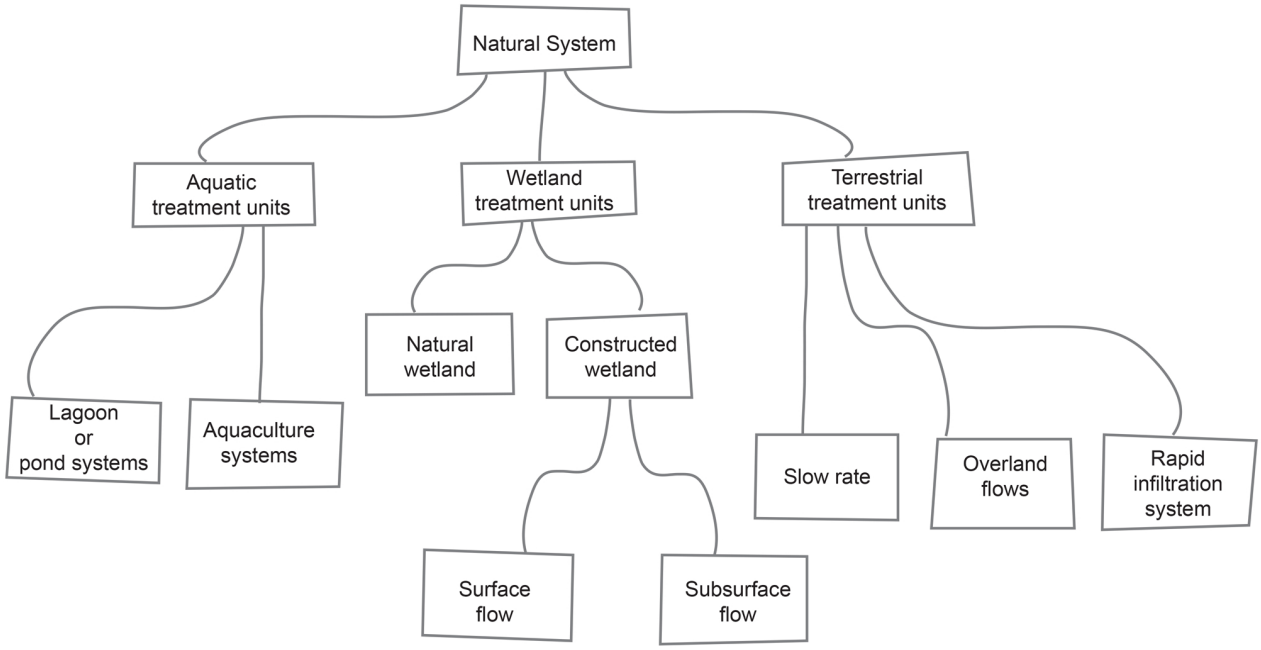


Source:
Tilley, E., C. Lüthi, A. Morel, C. Zurbrügg and R. Schertenleib. (2008). *Compendium of Sanitation Systems and Technologies*. Duebendorf, Switzerland: Swiss Federal Institute of Aquatic Science and Technology (Eawag), pp. 20



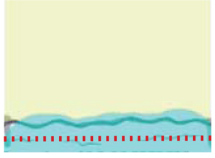
Source:
Tilley, E., C. Lüthi, A. Morel, C. Zurbrügg and R. Schertenleib. (2008). *Compendium of Sanitation Systems and Technologies*. Duebendorf, Switzerland: Swiss Federal Institute of Aquatic Science and Technology (Eawag), pp. 24

Box 4.1. Natural Systems for Waste Management and Treatment (Based on Reed *et al.*, 1988 with author's illustrations)



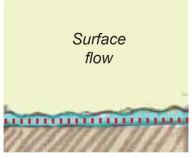
Aquatic treatment units
The major treatment responses are due to the biological components and physical sedimentation with water as media

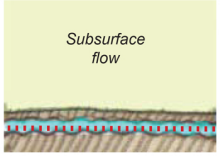
Lagoon or pond systems depend on microbial life and incorporate lower plants and animals.



Aquaculture systems incorporate higher aquatic plants or animals (floating plants, fish and other animals, planktonic organism and submerged plants) as a component in a wastewater treatment system, either monoculture or polyculture operation.

Wetland treatment units
Wetland are defined as land in which the water table is at (or above) the ground surface long enough each year to maintain saturated soil conditions and the growth of related vegetation

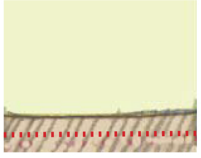




Natural wetlands i.e. natural marshes, swamps, strands, bogs, peat lands, cypress domes.

Constructed wetlands ensure much more reliable control over the hydraulic regime in the system and therefore perform more reliably than natural ones.

Terrestrial treatment methods
It is dependent on the physical, chemical and biological reactions on and within the soil matrix



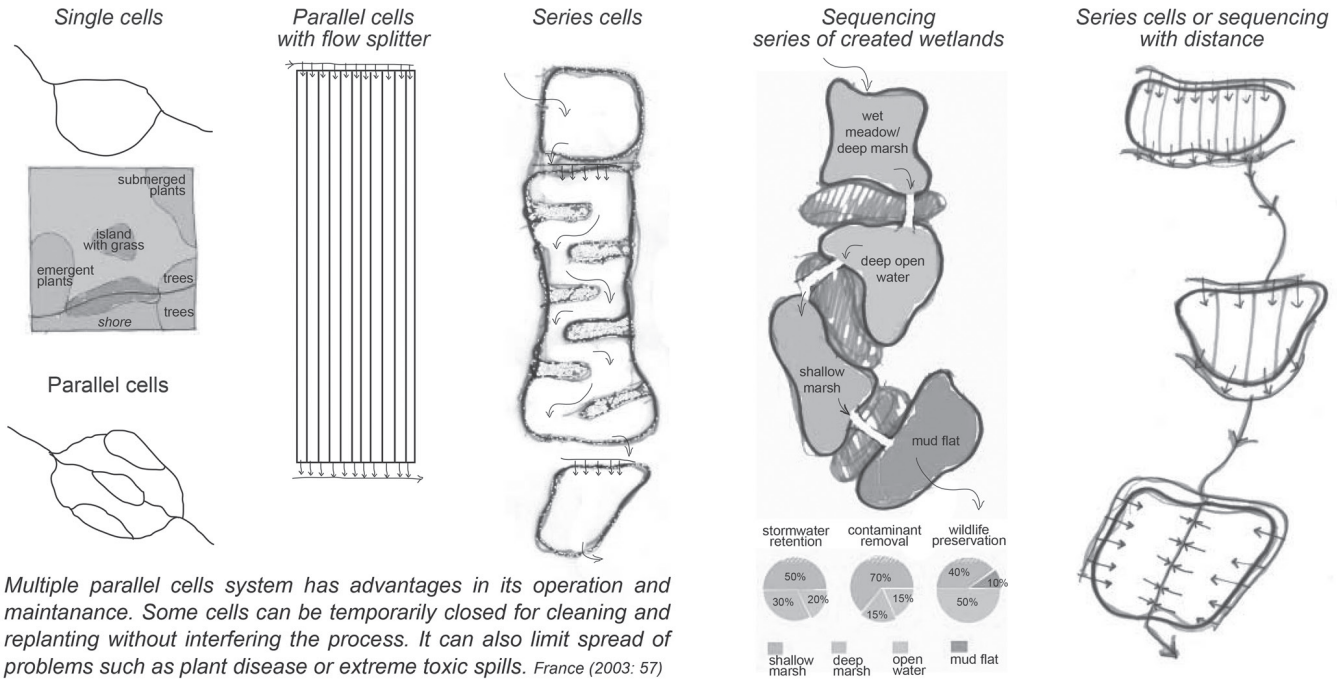
Slow rate systems utilize a wide range of vegetation, from trees to pastures to row crop vegetables.

Overland flow systems use perennial grasses to ensure a continuous vegetated cover.

Rapid infiltration systems have high hydraulic loading rates so that cannot support beneficial vegetation.

Source:

Putri, P. (2008). *Reclaiming Waterways for Urban Regeneration - Testing an Urban Design Model of Water Management Strategy on Cikapundung River Basin, Bandung, Indonesia*. KU Leuven, Master Thesis, p. 49



Multiple parallel cells system has advantages in its operation and maintanance. Some cells can be temporarily closed for cleaning and replanting without interfering the process. It can also limit spread of problems such as plant disease or extreme toxic spills. *France (2003: 57)*

Different spatial configurations of constructed wetlands
Source: Based on France, 2003 with author's illustrations

Source:
Putri, P. (2008). *Reclaiming Waterways for Urban Regeneration - Testing an Urban Design Model of Water Management Strategy on Cikapundung River Basin, Bandung, Indonesia*. KU Leuven, Master Thesis, p. 51